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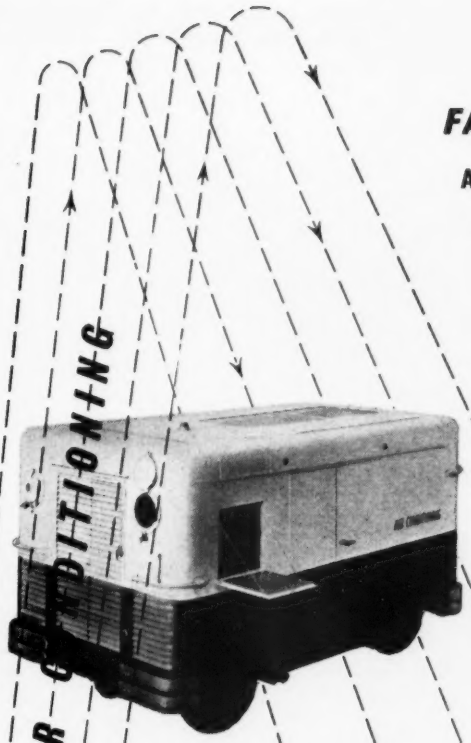

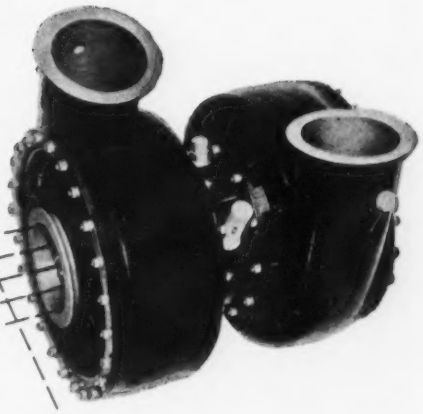

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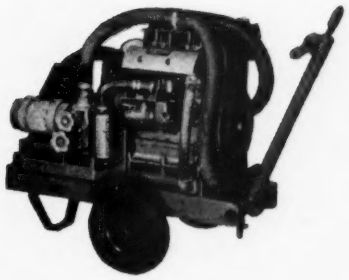

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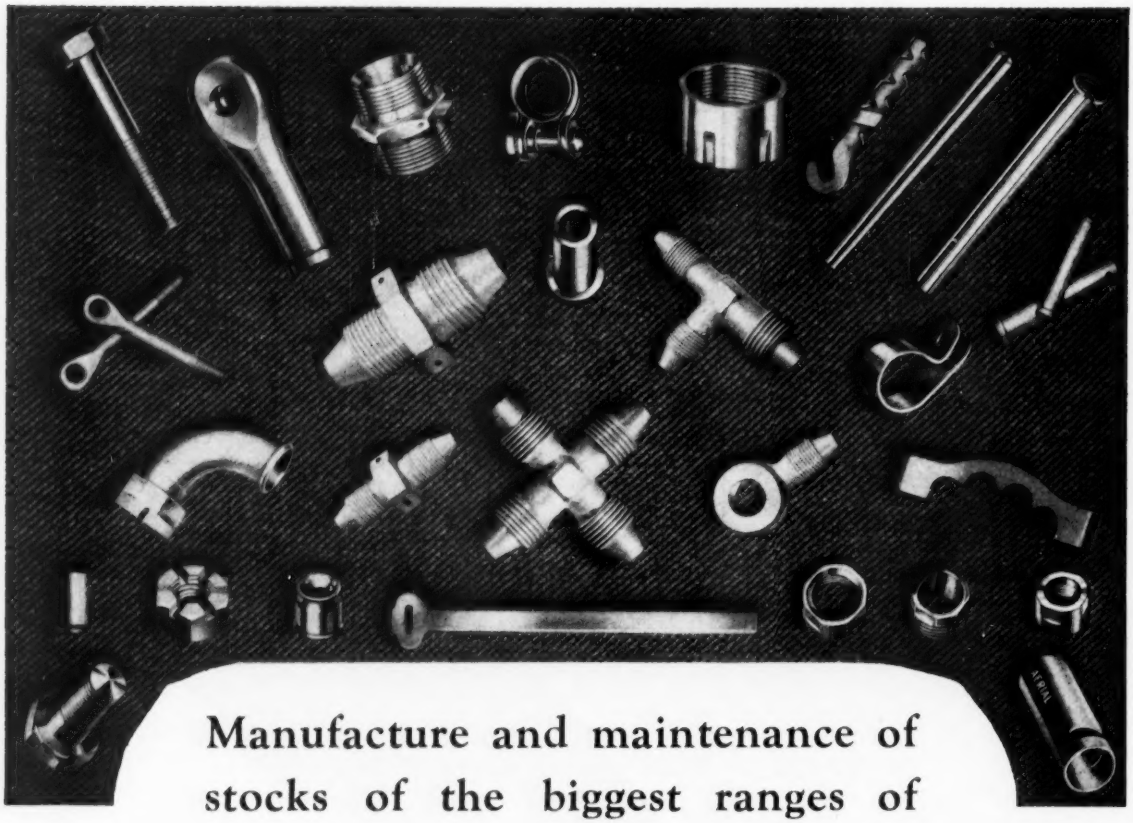

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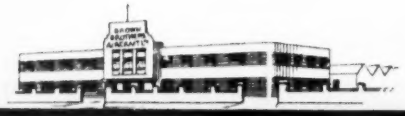

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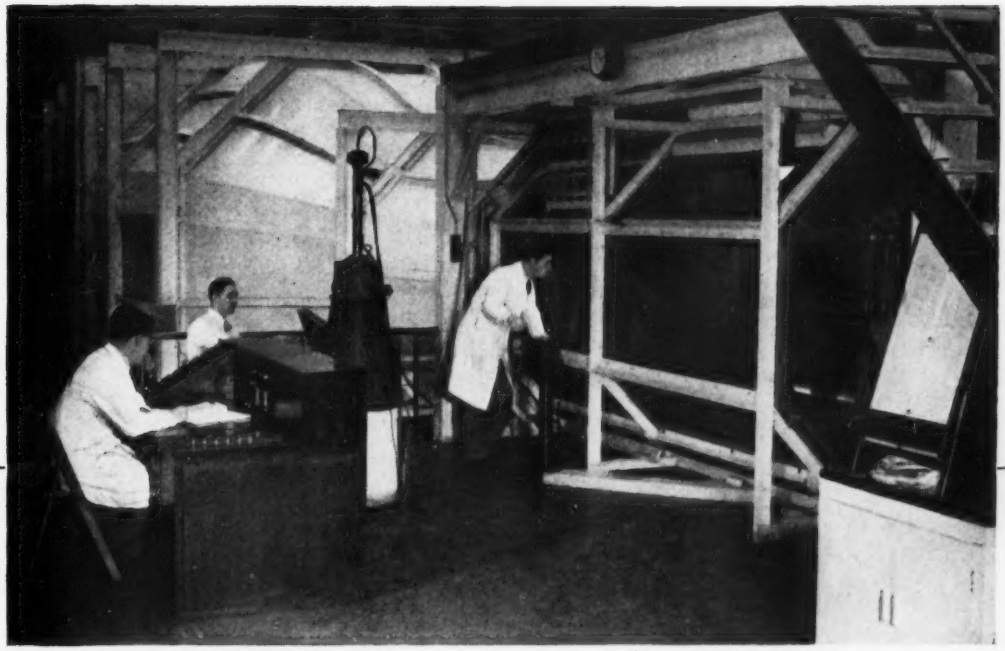

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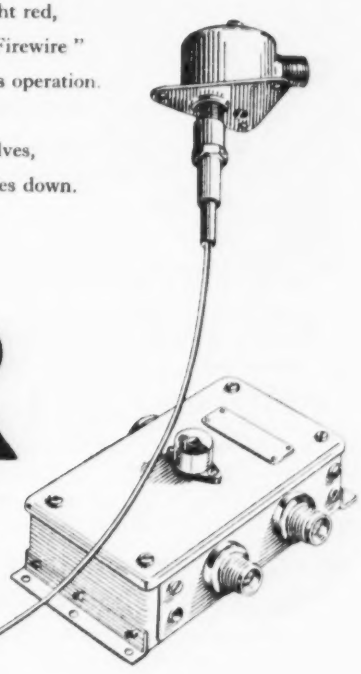

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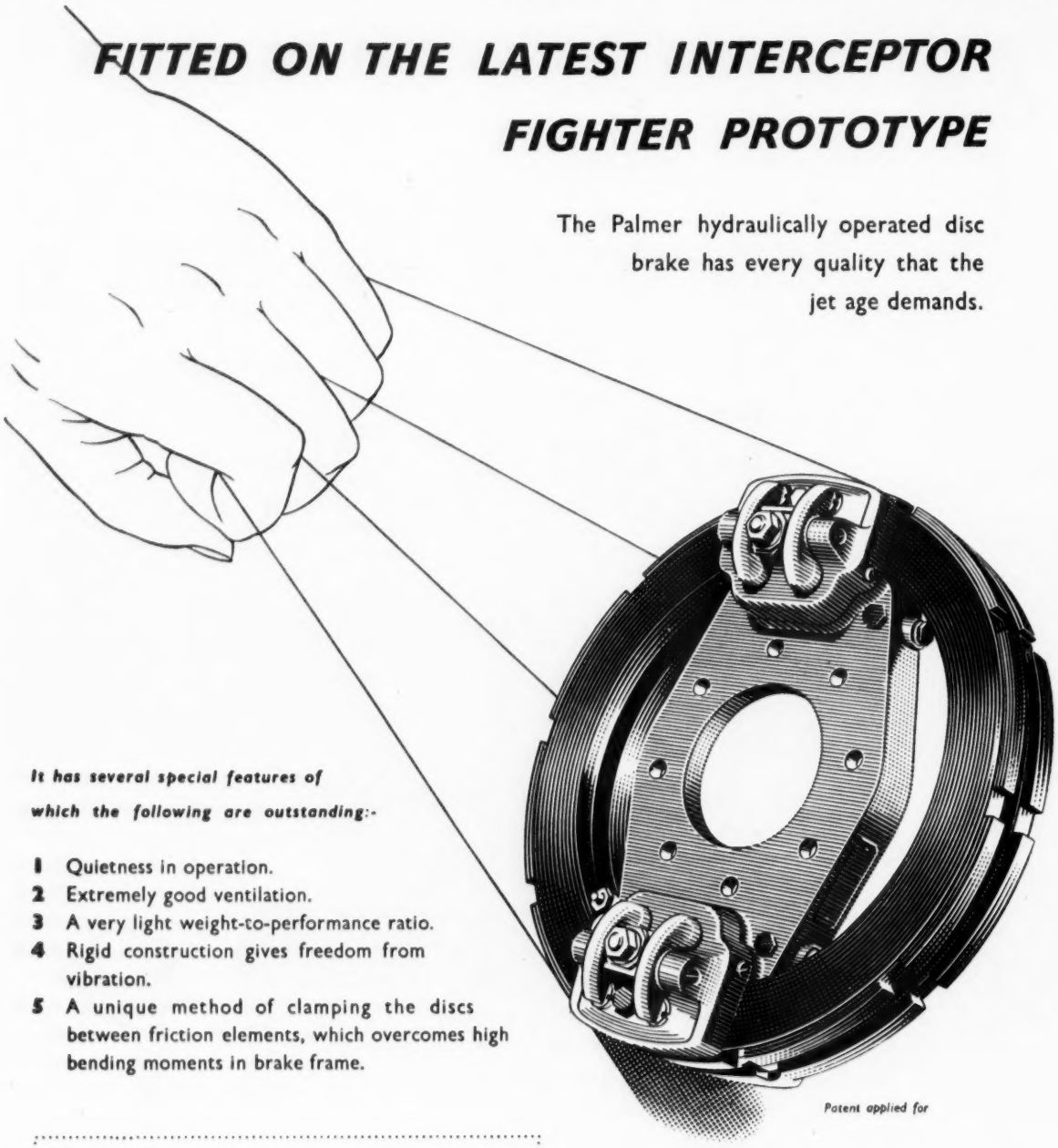

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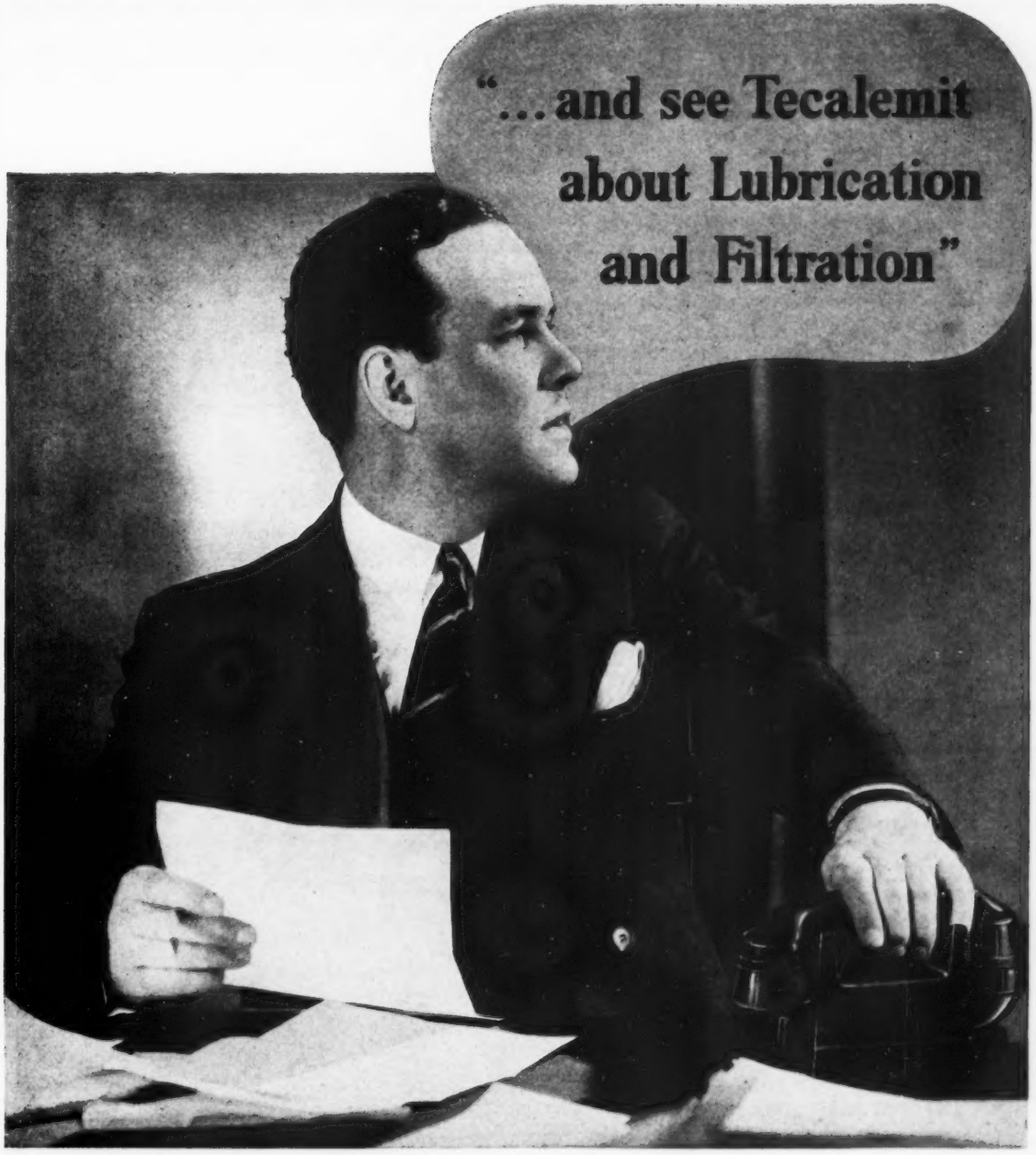

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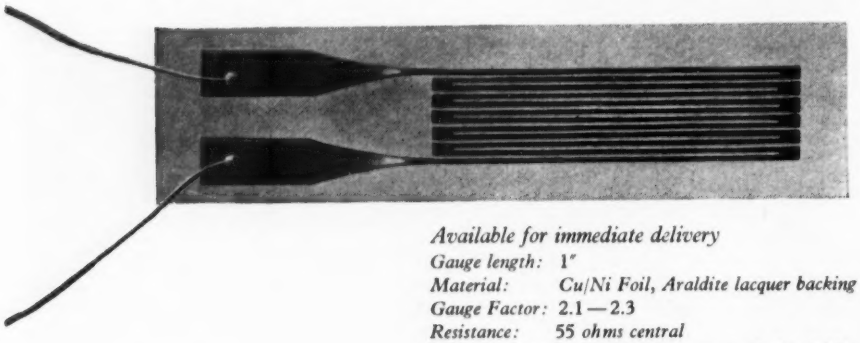

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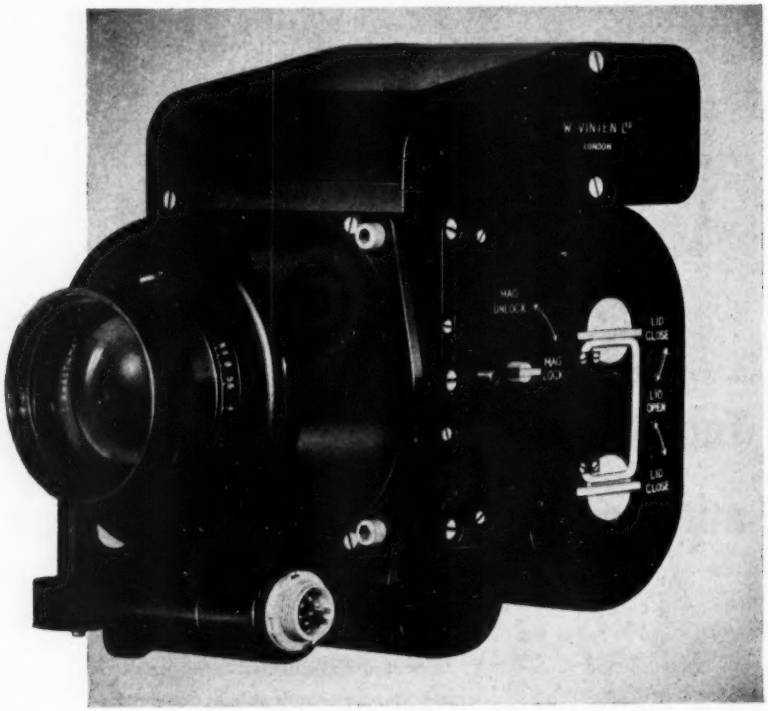

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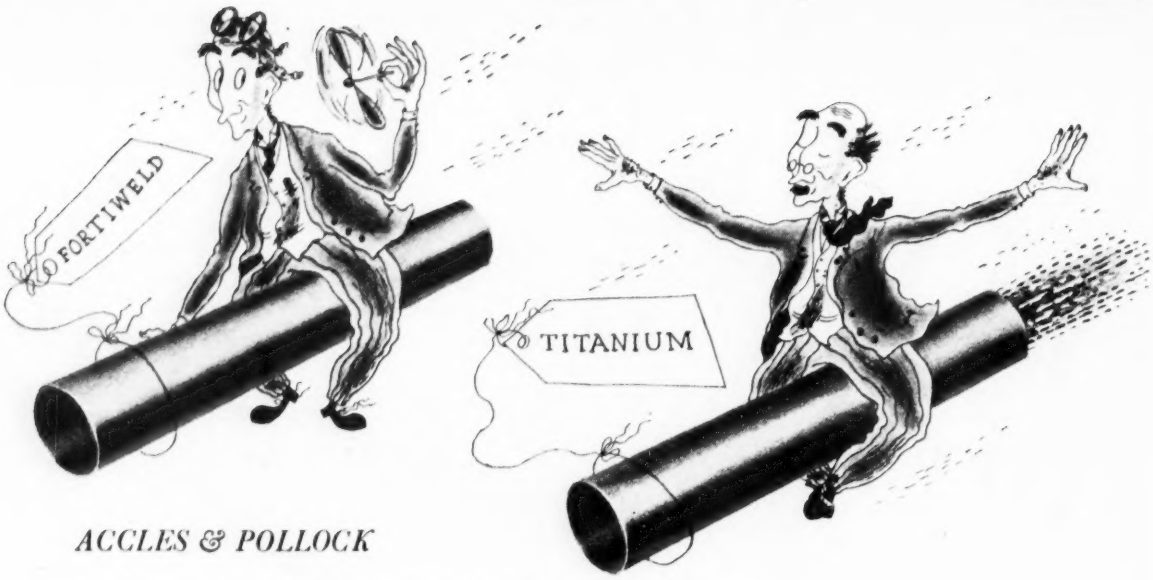

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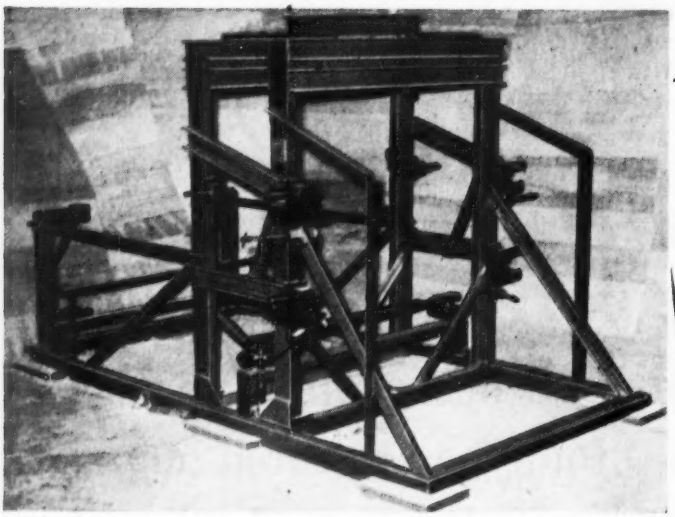

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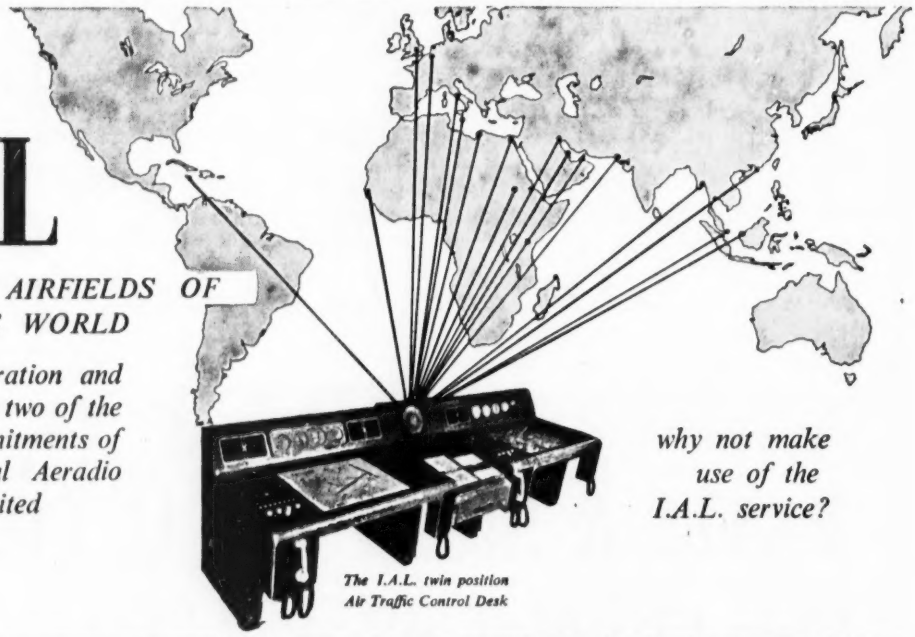

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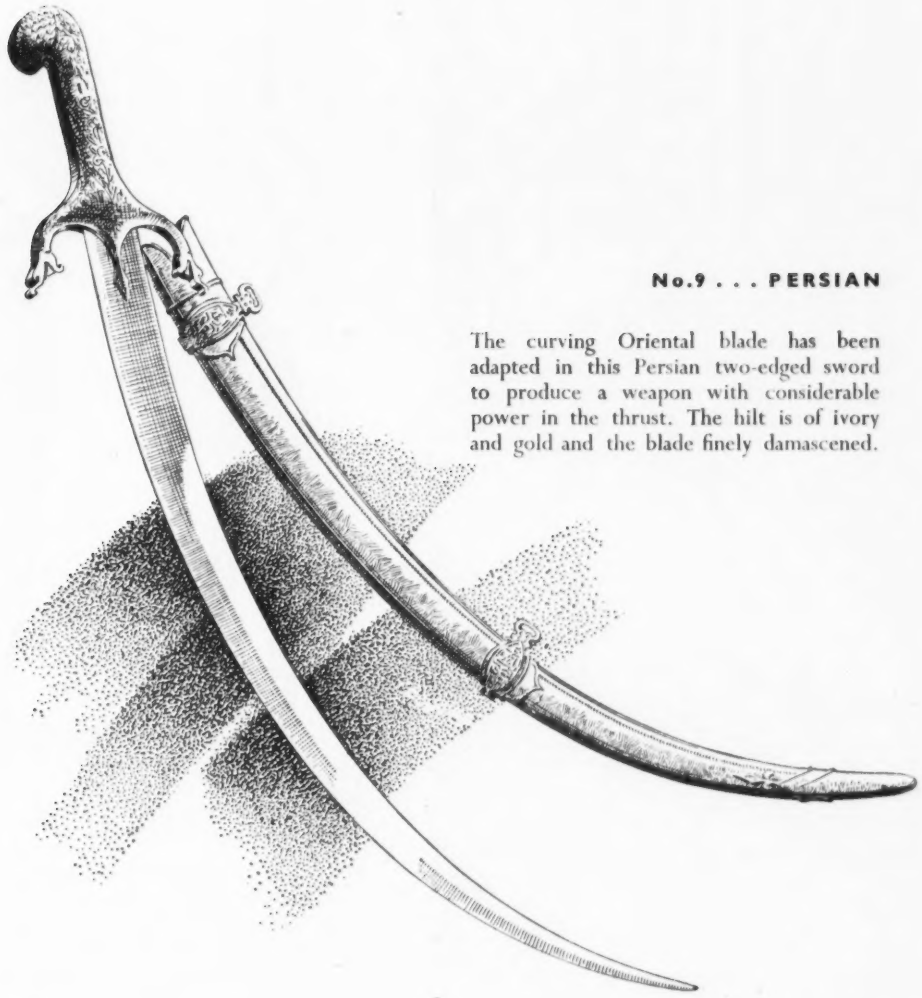

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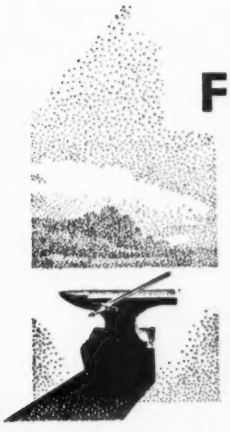

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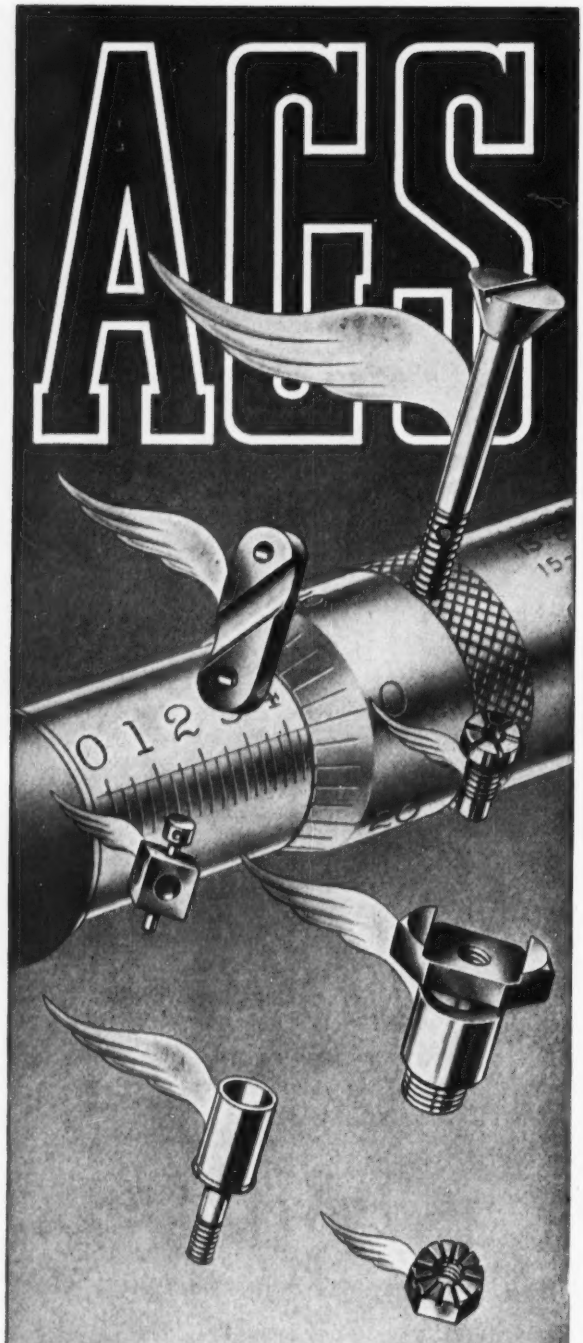

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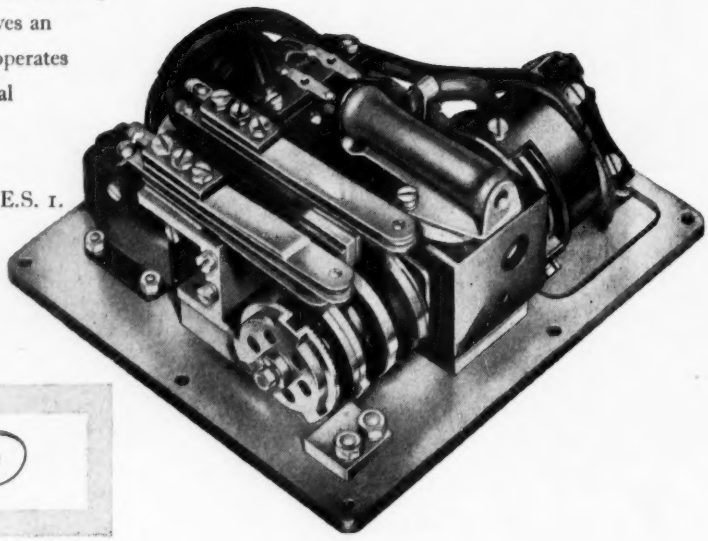

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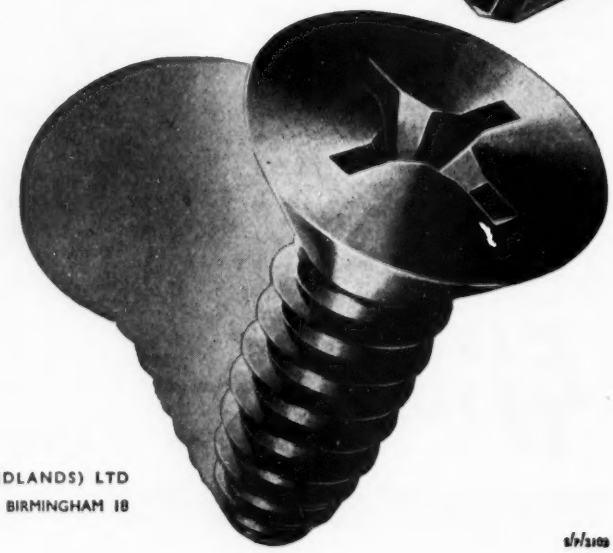

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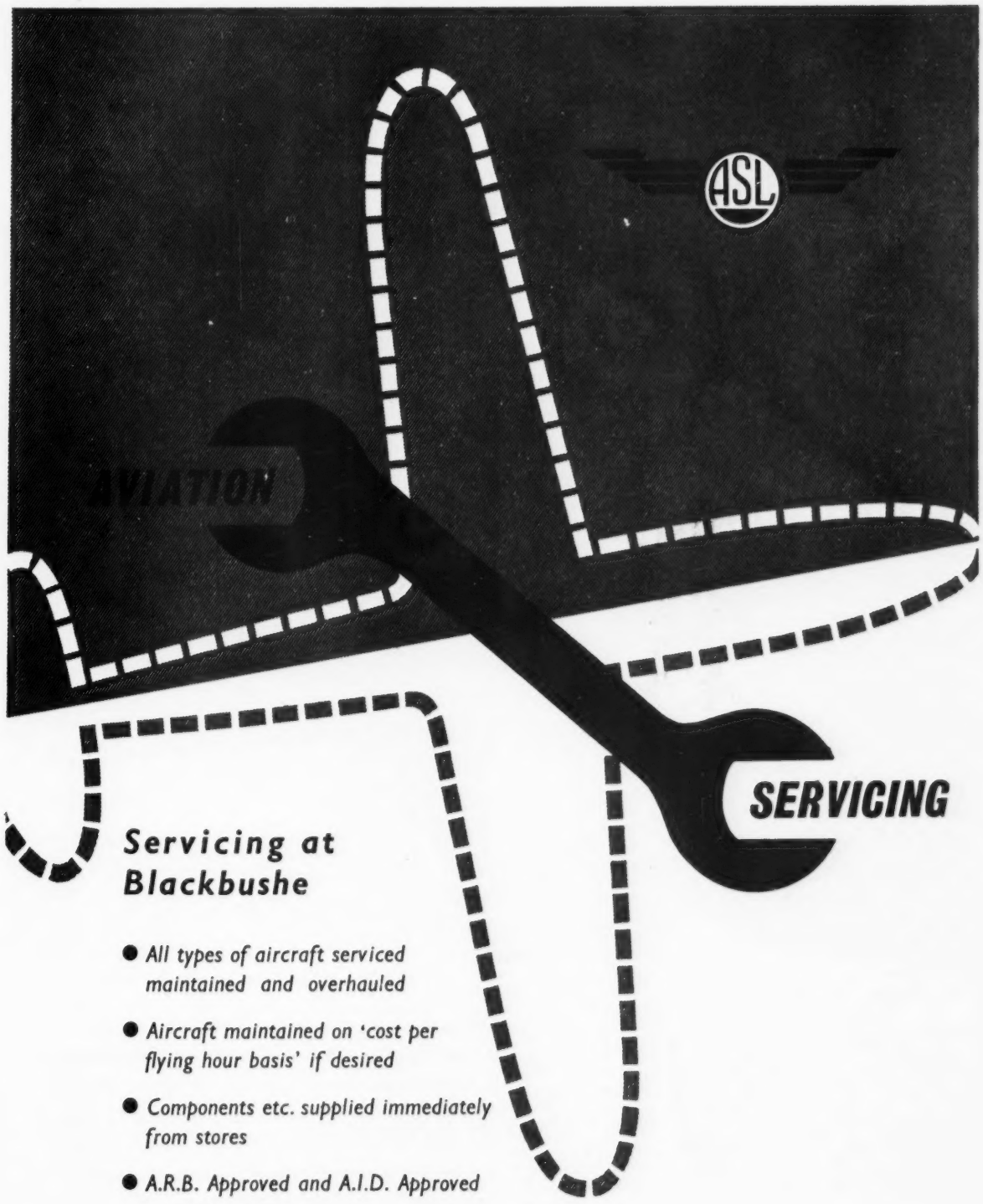

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Left, Right?

WHAT is going on in commercial aviation today reminds us of the proud mother who, having recognized her son in the marching column of troops, observed that "Our Albert's the only one in step." Among the many major aircraft manufacturers in a highly competitive world industry, one British company alone is producing turbojet transports. Are all the others, in fact, out of step and behind the pace of progress?

In this special Commercial Aviation Number of *Flight* the considered opinions of the chiefs of the principal aircraft-manufacturing companies of the free world comprise a most important feature that we are specially proud to print. Readers will detect at once how the British and the American spokesmen differ in their attitudes towards present-day aircraft requirements. The differences are of "when" rather than of "how." Inevitably the question is raised: Are the British right, and have the Americans been left at the post?

In some quarters much is made of State aid to British manufacturers and operators. That some assistance has been given, both directly and indirectly, is freely acknowledged by the companies themselves. But in justice to the enterprise of the de Havilland, Vickers and Bristol companies, it must be remarked that without their own efforts and initiative, and their shareholders'money, it is doubtful whether we should be any farther advanced than the Americans are today. Most people know very well that there are all sorts of ways of providing subsidies indirectly; the British way happens to be more direct and obvious than many others.

There can be very few commercial aircraft of any nationality in operation today that have not wholly or in part been made possible by direct subsidy or as a result of military development and production contracts. And under what heading should the "World Bank" purchase of K.L.M.'s new Constellations be considered? And, again, what of the various other fleets of aircraft acquired by special arrangements for impecunious and dollar-starved countries? We believe that both generosity and a commendable spirit of international co-operation have inspired most of these aircraft deals.

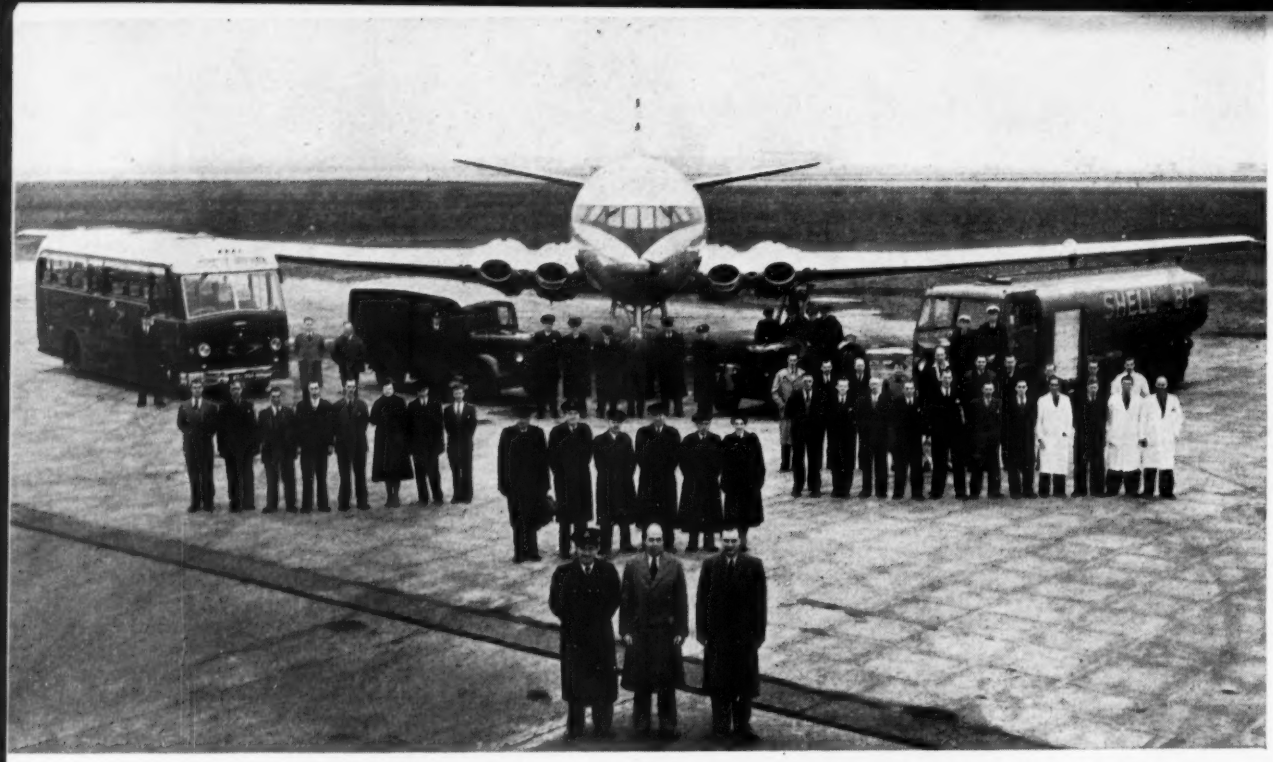
On the subject of pure-jet economics the United States spokesmen have a stronger case for the continued retention of their efficient and profitable pre-war and war-time designs. Let us admit right away that Ghost-powered Comet 1s, the first of our new family, are not likely to make as much money, except perhaps on picked routes, as might the best American machines of less advanced design. Yet there is little doubt that, to the embarrassment of their critics, they have proved tractable, reliable and economical; and such has been their appeal in the hands of B.O.A.C. that they have commanded substantially better load-factors than other older types—better even than the high figure required initially to make them pay. And how should the experience and prestige be evaluated?

As for turboprops, much may depend in future upon airscrew development. Opinions on the future for such transports seem to vary widely among individuals, regardless of their nationality. Existing airframes re-engined with turboprops can be expected to make only mediocre aircraft. Viscounts, with Rolls-Royce Darts, are now selling on their economics alone in straight competition with the latest piston-engined types.

If turboprops can offer a really low specific fuel-consumption, they may give the pure jet a run for its money over all stage-lengths rather than only over the short and very long ones. Such supersonic airscrews as exist are still strictly experimental and both their noise and their low-speed and take-off characteristics may prove serious drawbacks to their use for high-speed airliners.

Maximum foreseeable operating speeds of the two contenders seem to be 450-475 m.p.h. for turboprops and 575-600 m.p.h. for turbojets. Rates of doing work are comparable, one type moving loads more quickly, the other, for similar airframe size, taking rather bigger loads. Supersonic airliners are no nearer than the farthest horizon; they may even have to await atomic power to become a practicable proposition.

The chances are, we believe, that Great Britain will in the future be held to have taken a bold but fully justifiable step in introducing jet airliners in 1952. The continued success of all turbine aircraft will depend very greatly upon the availability of good economical power units. It is in this field more than in airframe design that foreign manufacturers may experience their greatest troubles as they strive to shorten the British lead.



TEAMWORK : A B.O.A.C. Comet and the men—and women—engaged in its operation. (See "Keeping them Flying," below.)

FROM ALL QUARTERS

Keeping Them Flying

THE striking photograph in the heading forms a particularly appropriate introduction to this Special Commercial Aviation Number of *Flight*. Since the inauguration of the world's first and (so far) only jet airline service ten months ago, B.O.A.C.'s Comets have flown over 10,000 hours and carried nearly 17,000 fare-paying passengers. Behind this achievement are the combined efforts of many specialists at different levels: management, operational and ancillary. In the picture above the aircraft gives pride of place to 54 representatives of the B.O.A.C. Comet Fleet and of the other departments at London Airport, whose contribution—though vital for success—is often overlooked.

The trio in the foreground are (centre) the Comet Fleet manager (Capt. M. J. R. Alderson), the officer i/c. training (Capt. E. E. Rodley, left) and the fleet maintenance engineer (Mr. R. A. V. Dismore, right). Behind them are a crew—captain, first officer, engineer officer, radio officer, steward and stewardess.

The line-up of eight people on the left are the flying staff administration, fleet communications, fleet liaison and operations planning and operations officers; the fleet secretarial staff representative; fleet navigation officer; and representative of the flying-staff services.

In the front rank of the squad on the right are the senior inspector, technical officer, fleet supplies officer, fleet planning engineer, base engineer superintendent, foreman, two chargehands, leading hand, instrument instructor and chargehand (instruments). The second rank consists of the technical records representative, methods planning engineer, a technical officer, engineering secretarial-staff representative, chargehand (electrical), leading hand (sheet metal), chargehand (hydraulics), fitter, inspector (instruments) and leading hand. Behind them are the refueller crew of two.

Under the port engines are the tractor crew of four, and beneath the nose (reading now from right to left) are a security warden, an aircraft loader, station operations representative, officer i/c. aircraft catering, officer i/c. service control (representing traffic branch—passenger, freight and mail handling), and the station duty officer.

Next is seen the freight and catering equipment van and its driver, then two M.C.A. personnel, the tarmac marshal and the air-traffic controller. The remaining member of the team is the passenger-coach driver.

To Rule the Waves

FURTHER news of the maritime-reconnaissance Britannia was given by Dr. A. E. Russell, director and chief designer of Bristol's Aircraft Division, as he was leaving for Canada last Saturday. He is to hold discussions with Canadian Service and Defence chiefs in connection with the production of the aircraft by the Canadian Government—to be undertaken by Canadair, Ltd., according to an American report.

The Britannia sub-hunter would, said Dr. Russell, be powered by four Napier Nomad compound engines and would be capable of "flying the Atlantic from Canada to the British coast on anti-submarine warfare." Guns would be fitted in the wings and there would be provision for a heavy load of torpedoes.

Remarking that the present British civil Britannia is not scheduled for delivery to B.O.A.C. until 1955, Dr. Russell said that the Canadian-built military aircraft—which would bring in a large dollar income for Britain—would appear before then.

M.C.A. to be Absorbed

MR. CHURCHILL announced to the House of Commons on February 26th that it had been decided to amalgamate the Ministries of Transport and of Civil Aviation.

In doing so he reminded the House that it was the policy of Her Majesty's Government to make such changes in the organization of departments as would simplify administration and reduce costs.

There were cries of "hear, hear" when the Prime Minister related these remarks to the Ministry of Civil Aviation. He said that the change had been under consideration for some time, and the way to it had been paved by the appointment of the same Minister (Mr. Alan Lennox-Boyd) to the two departments. There would continue to be two Parliamentary Secretaries, one dealing with transport matters, and one (Mr. J. D. Profumo) with civil aviation. The new Ministry would be known as the Ministry of Transport and Civil Aviation.

In reply to questions, Mr. Churchill said that a White Paper would in due course be laid before the House describing the effect of the changes in greater detail.

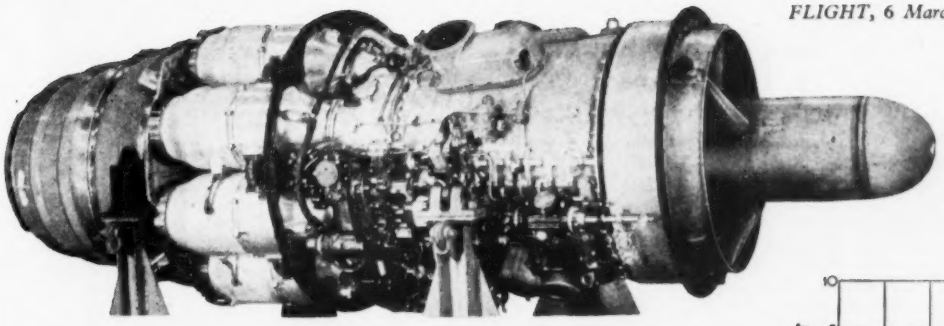
It is not expected that the proposed amalgamation will take place before late summer.

Despite its early viscissitudes, there is no doubt that the M.C.A. is today doing a fine, and very valuable, job. Included within its structure are many excellent men and committees, who have at last been allowed to settle down and show their true worth. If the amalgamation disturbs their work it will do a disservice to the nation; but, clearly, further comment upon the decision must await publication of the White Paper.

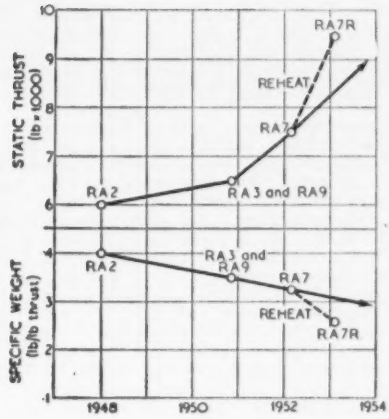
Avon Progress

ADDITIONAL details may now be published of the development of the Rolls-Royce Avon turbojet that has been effected during the past four years. Performance prediction for the early Avons was very conservative, the experimental RA.2 having a rating of but 6,000 lb thrust. This was later raised to 6,500 lb in the RA.3 which went into production in June, 1950, to power the Canberra.

Parallel with RA.3 production, further development was carried out to meet fighter requirements, to incorporate full anti-icing and to increase thrust. The outcome of this development was the RA.7, which was put through a 150-hour type-test in March, 1952, at a rating of 7,500 lb thrust. Engines of this rating were flown at the S.B.A.C. displays of 1950, 1951 and 1952. In September last, delivery of the RA.7 to aircraft constructors began, while develop-



Weight/power relationship for some Avons is shown in the graph below—which does not, of course, include mention of the much more advanced Avons under development.



SERIES SEVEN: The Avon RA.7 (shown above, and referred to at left) is the latest sub-type of which details may be given. Much additional equipment is carried by the new engine, yet the weight has increased only slightly in comparison with that of earlier Avons.

ment work on re-heat produced the RA.7R, which successfully passed its 150-hour type test in January of this year at a rating of 9,500 lb thrust.

In addition, further Avon development has produced the RA.14 and a civil engine of 9,000 lb thrust without afterburning. Although no performance figures may be quoted for the RA.14, it may be assumed that its static thrust without afterburning will probably be not less than 9,000 lb. Nine different Avons are currently in production, seven being of RA.7 rating, and the others corresponding to the RA.3 and RA.9. As with the Merlin, these variants of the basic Avon have been developed for fighter, bomber, naval and civil aircraft. The RA.7 will be manufactured under licence overseas. The incorporation of a complete anti-icing system is a major development and it will be provided on all production RA.7s as from this month.

Aquila Airways Purchased

FIRST news was released on Tuesday of an important transaction affecting two British independent airline companies. Aquila Airways, Ltd., have been bought outright by Britavia, Ltd., parent company of Silver City Airways, and two directors of the latter company—Mr. E. C. Mekie and A. Cdre. G. Powell—are expected to join the board of Aquila. W/C. Barry Aikman will continue to manage Aquila Airways but the staff and maintenance and bookings facilities will be integrated with those of Silver City. Aquila will continue to operate flying-boats, principally on the well-known Southampton-Madeira service.

Loss of a C.P.A. Comet

AS we close for press we learn with great regret that the first Comet 1A to be delivered to Canadian Pacific Airlines was destroyed with the loss of eleven lives when taking off at night from Mauripur, Karachi, last Monday, March 2nd. The aircraft, CF-CUN, *Empress of Hawaii*, was on its delivery flight to Australia and had landed to refuel for the next leg to Singapore. First, unofficial, reports state that the aircraft travelled 3,270 yards along the ground before crashing into a deep ditch beyond the runway and catching fire, and that the tail had been scraping. Those who lost their lives were D. H. Edwards, H. Waters, D. Morgan-Tipp, B. Rees, and J. Wilson of the de Havilland Company; N. G. Gardner, of Smiths Instruments (Australia); and the Canadian crew—from Vancouver—Capt. C. H. Pentland (director, overseas flight operations), Capt. North Sawle (chief pilot, overseas lines), P. D. Roy, R. J. Cook and J. Smith. The aircraft was to have opened the Sydney-Honolulu service on April 28th.

Luftwaffe Revival Plans Disclosed

WEST GERMAN RADIO reported last Sunday night that "A spokesman of Herr Blank's office [Blank is the future Bonn Minister of War] said in Bonn today that the organizational preparations for the raising of a German Air Force contingent were virtually completed. If the E.D.C. treaty were ratified, the Federal Republic would have, within the tactical European forces, a total of 20 basic units with 1,326 aircraft and 80,000 men. These figures had been agreed upon in the negotiations about the E.D.C. treaty."

The speaker then went on to quote the following "breakdown": Ten basic units of fighter-bombers and ground attack aircraft, with 75 aircraft for each unit; four units of fighter for air defence, also with 75 aircraft per unit; two units of all-weather fighters, with 36 aircraft in each; two reconnaissance units with 54 aircraft each; and two transport units with 48 aircraft each.

Herr Blank's spokesman had also said that the German Air Force contingent within the Allied Tactical Air Force was proportional to the German army contingent, and could be described as strong. Compared with the other E.D.C. countries, the Federal Republic had certain disadvantages with regard to the Air Force.

It would be the first task of the A.T.A.F., operating within NATO, to safeguard the air defence of Europe in co-operation with the anti-aircraft defences. Its second task would be to achieve, with the Strategic Air Force, air superiority. The main task of the German Air Force units would be support of the ground groups.

The jet fighter would be the standard type of a European tactical air force: it would be equipped for special tasks such as air reconnaissance, all-weather flying, and fighter-bomber action. Experience gained during the second world war and in Korea had been taken into account.

The report continued: "Experts of Herr Blank's office—officers of the former Air Force with high personal and professional qualifications—point out that the raising of the national air force would be impossible if only for financial reasons, and that for this reason alone a European integration was an inevitable necessity."

Mr. P. J. C. Vos

THE sudden death, following an operation, of Mr. Pieter J. C. Vos will come as a severe blow to his many friends and admirers in this country. Mr. Vos, who was in only his fiftieth year, was commercial director of the Fokker Aircraft Company and a member of the Netherlands Aircraft Development Board. He was also a founder of the International Association of Aircraft Constructors, and for this work was awarded the French Legion of Honour. Before joining the Dutch Air Force in 1927 as an observer Mr. Vos had studied mechanical engineering at the Technical University at Delft. Later, for a time, he was with the Royal Packet Steamship Company and subsequently he joined Fokker.

Mr. P. J. C. Vos.

Many people in this country will recall Mr. Vos's escape to England in 1941, made in company with a test pilot in a Fokker G.1 fighter. On arrival here he joined the R.A.F., became a pilot and served as an instructor and flight commander, taking part also in many operational sorties. Later he joined the Dutch Air Force in England, and at the end of the war was appointed director of K.L.M. in London. For his work in this country he received an O.B.E. After the liberation of Holland he served in various official capacities, including membership of the board of the National Aeronautical Laboratories and later as presiding director of the United Dutch Aircraft Factories.

We recall Mr. Vos as a cheerful and always charming enthusiast for everything aeronautical. He was a good friend of Britain. Not only Fokker but international aviation will feel his loss.

ABOUT THE AIR ESTIMATES

TO accompany this year's Air Estimates, the Secretary of State for Air, Lord De L'Isle and Dudley, V.C., has prepared a Memorandum, which is available together with the Air Estimates, 1953-54, from Her Majesty's Stationery Office*. In this he summarizes the developments of the past year, explains items in the Estimates, and comments on the re-equipment of Royal Air Force Squadrons.

Prefacing his remarks with the statement that the total of Air Estimates for 1953-54 is £498 million, the Minister points out that this allows for the receipt of £50 million in consequence of the grant of defence support aid by the United States towards the burden of defence undertaken by the United Kingdom in the common cause. The corresponding figures for 1952-53 were £437,640,000 and £30 million respectively. The net total for the current year is £80,360,000 more than last year. This increase, it seems, results from the continued expansion and re-equipment of the R.A.F., from increases in price and from provision of services hitherto provided from other funds.

The peak of the R.A.F. works programme has now passed, and during the year the training organization will begin to contract. On the other hand, the industrial preparations made over the past two years are showing results in increased expenditure on aircraft, ammunition, electronic equipment and instruments. The increase in expenditure on aircraft would have been greater had not the Government decided to concentrate on the production of the most advanced types of aircraft and to reduce purchases of those less advanced. This decision has slowed down the rate of expansion of the R.A.F. but the standards of training, serviceability of aircraft, and administration efficiency have improved.

The Secretary of State writes that during 1952 the number of flying hours was one-third greater than during the previous year. The largest single expansion was in the Second Allied Tactical Air Force. Day and night fighter forces will continue to expand, and the first British-built swept-wing fighter, the Swift, will be introduced into service during this year. Lord De L'Isle and Dudley refers to the most welcome offer of F-86 Sabres under the United States Mutual Security programme, and states that the R.A.F. is greatly indebted to Canada and the U.S. for the supply of these aircraft. The first R.A.F. Sabre Squadron will shortly be forming in Second A.T.A.F. Already Squadrons are receiving Venom fighter-bombers and the Meteor night fighter force has been substantially reinforced.

Reference is made to the Coronation day fly-past and the Royal Review of the R.A.F. at Odiham. Of the New Zealand Race, it is stated that it will provide valuable training in long-range high-speed flight for crews of the Valiant and Canberras.

During 1952 the output of trained air crew was double that of 1951. An improved Vampire jet trainer is to be introduced in 1953, and the Provost basic trainer will be replacing existing types.

The cost of air trooping on the routes for which contracts have so far been let, is, in general, not more than the cost of sea transport without taking into account the savings in the time during which personnel are non-effective while at sea. The amount of air trooping by charter companies has increased for all three Services from 25 to 49 per cent. About 85 per cent of trooping to the Canal Zone is now done by air.

Air Estimates, 1953-54

WE have remarked on previous occasions that there is much of general interest to be learned from the printed Air Estimates, in spite of the rather formidable and dull appearance of some 250 pages of tables and close-printed explanations. Many will be interested to learn the details of how nearly £500 million is to be spent in a year on their defence.

An examination of the abstract of the Air Estimates shows that while there were decreases under Votes for Pay, Reserve and Auxiliary Services, and Works and Lands, substantial increases are shown for Aircraft Stores, Supplies, and other items. The Votes are explained as follows:—

Vote 1, concerned with Pay, for which the estimate is £85,570,000, shows a net decrease of £1,680,000. The decrease is due to an expected reduction in the proportion of married personnel, marriage allowances being down by £1,900,000, and also to the reduction in the number of officers to be commissioned and in the rates of allowances for outfits and tropical kits. Offsetting these reductions are the higher average rates of pay and the increased rates of employers' insurance contributions.

Vote 2 is concerned with Reserve and Auxiliary Services. It totals £1,690,000, a net decrease of £129,900, explained mainly by the reduction in the scale of training for R.A.F.V.R. air crew.

Vote 3, for the Air Ministry, is estimated at £3,980,000, an increase of £80,000.

Vote 4, for Civilians at Outstations, is for an estimated sum of £26,930,000, an increase of £810,000. Under this Vote the wages of industrial employees show an increase of £1,365,000.

Vote 5 concerns Movements. The estimate is for £12,700,000, an increase of £800,000. The increase is due to the greater number of movements of personnel to and from Commands abroad, and to higher rates of travelling allowances. The cost of stores conveyance is reduced, and there is an increase under Appropriations in Aid due to provision for conveyance of a greater volume of mail for the Post Office, and to an increase in the number of special flights for other defence departments. Estimated costs of journeys by various methods for the current year, with those for last year in brackets after them, are as follows:—

	1953-4	1952-3
Rail and short sea journeys ...	£2,980,000	(£3 million)
Road journeys	£620,000	(£520,000)
Sea passages	£1,920,000	(£960,000)
Air passages	£800,000	(£700,000)

The conveyance of stores by air is expected to cost £140,000 in the current year as compared with £50,000 last year.

Vote 6, for Supplies, is for £90,480,000, an increase of £24,215,000. Although food and ration allowances are to cost £1,580,000 more, by far the greatest increase is for liquid fuels and lubricants. This is not so much a result of the higher cost of aviation fuel as of the greatly increased quantities to be purchased.

Vote 7, Aircraft and Stores, estimated at £195,250,000. The increase of £34,250,000 is explained in the Memorandum above. The total estimate breaks down as follows:—

A. Aircraft ... ... £140 million (increase £29 million).
B. Armament, ammunition and explosives ... ... £34,500,000 (increase £5,500,000).
C. Radio, radar and electrical equipment ... ... £42 million (increase £21 million).
D. Instruments and photographic equipment ... £11,350,000 (increase £3,350,000).

Further sub-divisions under these headings show that the estimate for airframes is £57 million; for spares, components, accessories £28,500,000; and for engines £54,500,000 Under sub-heading C, radio and radar are expected to cost £33 million, and electrical equipment £9 million. Radio and radar includes ground as well as airborne equipment, also such items as field telephones, teleprinters, and cypher apparatus. Of the total estimate under sub-heading D, instruments account for £10 million, and in addition to flying and navigational equipment include such items as Link trainers, test equipment, high-altitude breathing apparatus, and radio-activity detection instruments.

Vote 8, Works and Lands, for which the estimate is £70 million, shows the largest single decrease, namely, £3,600,000. The reason for this is explained in the foregoing Memorandum.

Votes 9 and 10 are for Miscellaneous Effective Services and Non-Effective Services, respectively, and their totals are £6,810,000 (£4,745,000 increase) and £4,590,000 (£870,000 increase).

Vote 9 is concerned with such matters as telecommunications, training outside the Air Force, education, welfare, publicity, bankers' commission, compensation for losses and damage, miscellaneous civil flying services, maps and charts. The large increase is mainly due to the resumption of financial adjustment for the inland telephone, teleprinter and telegraphic services provided by the Post Office. This increase is partly offset by the reductions in flying training at civil schools. The increased Appropriations in Aid (£620,000) is for the larger number of Naval personnel to be trained at R.A.F. establishments.

Vote 10 is mainly concerned with retired pay, pensions, grants, gratuities, compensation and rewards. The increase is in anticipation of the increase in numbers of officers and airmen who will qualify for retired pay and pensions, and for terminal grants. It is also to cover improvements in rates of widows' pensions and gratuities.

Navy Estimates, 1953-54

THE Navy Estimates, 1953-54, have also been published*. The gross estimate is for £404,500,000, and Appropriations in Aid reduce this to £329,500,000. Included in these Appropriations is the sum of £35 million provided by the United States for defence support aid. By comparison with last year's Estimates there is a net decrease of £2,750,000.

Under Vote 8—Shipbuilding, Repairs, Maintenance, etc.—Section 3 is for contract work and sub-division A, concerned with ships and aircraft, provides for an estimate of £91,071,000, an increase of £15,033,000. Of this, aircraft including spares account for £17,837,000 as compared with £16,410,000 last year.

In a Statement accompanying the Estimates, the First Lord of the Admiralty refers in particular to the expansion of the mine-sweeping and anti-submarine forces. Work is to continue on the new fleet carrier *Ark Royal*, and on four smaller carriers of the Hermes class. The carriers *Victorious* and *Warrior* are being modernized. All the carriers in the active fleet (there are at present five) are now equipped with helicopters.

Her Majesty the Queen, accompanied by Admiral of the Fleet His Royal Highness the Duke of Edinburgh, will review the Fleet at Spithead on Monday, June 15th, 1953, from H.M.S. *Surprise*. Some 190 ships will represent the Royal Navy in the Review and 300 naval aircraft will take part in a flypast.

* "Air Estimates 1953-54" price 8s. Memorandum to accompany Air Estimates, price 4d. "Navy Estimates 1953-54", price 10s.

The Duke of Edinburgh presents a Britannia Trophy plaque to G/C. H. J. Wilson. On the Duke's left are A.V-M. Sir Charles Longcroft, Mr. Philip A. Wills, S/Cdr. J. W. Seddon, and, in the foreground, G/C. A. E. Clouston and F/L. P. Hillwood. (Right) This year's winners of the Trophy, for their return flight across the North Atlantic in a Canberra in 10 hr 3 min 29 sec: (l. to r.) F/L. P. Hillwood, W/C. R. P. Beamont, and S/L. D. A. Watson.

R.Ae.C. BRITANNIA TROPHY DINNER

THE evening of February 25th will long be remembered by the Royal Aero Club as one of its proudest occasions. Members were singularly honoured by the presence, informally, of H.R.H. the Duke of Edinburgh at a House Dinner given for the winners of the Britannia Trophy. The Duke personally presented plaques.

In a brief speech of welcome which delighted all present, Lord Brabazon, president of the R.Ae.C., said that the Club had been part and parcel of the aeronautical movement for over fifty years. Members were curious, perhaps because they lived in the future, not the past. Saying that guests were present to honour those who had laid the steps in progress which we walked up confidently today, Lord Brabazon added that it seemed only a few years since he had won £1,000 for flying a mile; some people regretted that those days were past. Turning to the Duke, he said: "We are proud of—though not stuffy about—our great history. We have never been so honoured, in all that history, as by your presence informally amongst us today. In your person, Sir, is embodied all that the worthy youth of this country stands for." Lord Brabazon then went on to say that members had been thrilled to hear of the Duke's decision to learn to fly. This could not have given more pleasure anywhere than to the Royal Aero Club. He concluded: "In you, Sir, we find a natural leader and inspiration. God bless you, and thank you very much."

The Britannia Trophy was a gift to the Royal Aero Club by Horatio Barber. Reference was made by Col. Preston to Barber's commercial flight in 1911, for which he received £100 (see page 244, last week). The cheque was handed to the Aero Club to buy a trophy to be awarded "For the British aviator who, in the opinion of the Committee of the Royal Aero Club, has accomplished the most meritorious performance in the air during the year." Of the 29 recipients since 1913, 16 were able to be present at the dinner, eight are no longer alive, and the remainder, living abroad, sent messages. The first to be awarded the Trophy was Capt. C. A. H. Longcroft (now A.V-M. Sir Charles Longcroft. In a brief speech on behalf of all winners, Sir Charles congratulated the Duke on his progress as a pilot.

The award of the Royal Aero Club's Gold Medal to Mr. Philip Wills, who won the World Gliding Championships in Spain in 1952, was also announced at the dinner.

Winners of the Britannia Challenge Trophy were as follows:—

Capt. C. A. H. Longcroft (1913); S/Cdr. J. W. Seddon, R.N. (1914); Sir John Alcock, K.B.E. (1919) (killed in a flying accident); S/L. H. J. L. Hinkler, A.F.C., D.S.M. (1920, 1928, 1931) (lost while attempting the England-Australia record in 1933); F. P. Raynham (1922) (now in Florida); Alan J. Cobham (1923, 1925, 1926); W/C. S. J. Goble, D.S.O., D.S.C. (died in 1948), and F/L. I. E. McIntyre (1924) (believed killed in an accident in about 1930); Lt. R. R. Bentley (1927); Lady Bailey (1929) (now in Cape Town); Charles Kingsford Smith (1930) (lost over the Indian Ocean in 1935 while attempting the England-Australia record); Capt. C. F. Uwins (1932); James A. Mollison (1933); Charles W. A. Scott (died in 1946) and Tom Campbell Black (1934) (killed in an aircraft taxying accident in 1936); Miss Jean Batten, C.B.E. (1935, 1936) (now in Jamaica); F/O. A. E. Clouston (1937); S/L. R. Kellett (1938) (now in Johannesburg); Alex Henshaw (1939); G/C. H. J. Wilson, A.F.C. (1945); G/C. E. M. Donaldson, D.S.O., A.F.C. (1946) (now in Fassberg); S/L. H. B. Martin, D.S.O., D.F.C., A.F.C. (now in Tel Aviv), and S/L. E. B. Sismore, D.S.O., D.F.C. (1947); G/C. John Cunningham, D.S.O., D.F.C. (1948); Philip A. Wills, C.B.E. (1950); Capt. O. P. Jones, C.V.O., O.B.E. (1951).

Mr. Horatio Barber sent a telegram from Bermuda regretting his absence. It is learned, incidentally, that his portrait is soon to be hung in the Club.

AIR-TRANSPORT POLICY

LAST week the Council of the Air League of the British Empire issued a lengthy memorandum on air-transport policy, intended "to re-iterate, as a matter of urgency," its views on "the vital necessity for the expansion on a large scale, and as quickly as possible, of this country's air-transport resources." The main point made in the memorandum is as follows:—

"The Council considers that an order of a hundred large transport aircraft, with accelerated delivery, represents a minimum programme to meet actual peace-time requirements if this country is to obtain its share of the world air-carriage market, and be able to meet the need which would certainly arise in the event of war.

"The air-transport fleet which could be formed from the 100 aircraft envisaged above, which should include a substantial proportion of heavy, end-loading aircraft capable of transporting heavy equipment, might, with the necessary provision of spares, cost more than £100,000,000. It would be possible for the larger independent operators themselves to raise enough finance to re-equip their fleets with modern aircraft if the Government were to provide them with sufficient guaranteed work over a sufficiently long period. Or the Government itself could advance the funds at a possibly lower rate of interest, thus making it possible for the companies to amortise the loans at an earlier date. But in either case the present trooping contracts need to be considerably extended and should be placed on a ten-year basis instead of the present basis of one to two years, which is too short for financial stability.

"The Council urges a great extension in the carriage by air of Government personnel, and also of Service and Government stores. This in itself would pay a dividend in increased efficiency. The creation of an air parcels service to the Empire would provide a new source of revenue both for the independent operators and the national airlines. It is quite possible that half the initial order of 100 aircraft could ultimately be employed for these purposes, together with normal commercial business which will develop considerably in the next few years.

"It is highly urgent that our independent operators should be enabled to re-equip their fleets with modern aircraft. Our competitors, who have access (in one case at least with assistance from the World Bank) to any and all sources of aircraft supply, are extending their hold on the world air transport market. There are six foreign air-cargo services across the Atlantic. B.O.A.C., of course, carries a substantial amount of freight, but there is no British all-cargo service across the Atlantic, and at present no prospect of a competitive direct service being opened unless special measures are taken to secure long-range cargo aircraft for British operators. As for air trooping, this cannot be fully exploited unless the independent operators are equipped with modern long-range aircraft.

"The balance of the 100 aircraft would be financed by loan from Government sources. A proportion of the aircraft so produced would be exported and the loan thus quickly extinguished. Any balance of aircraft not exported would either be used by the Royal Air Force or "Cocooned" for storage against emergency in exactly the same way as reserves of other kinds of aircraft and other munitions are stockpiled. There is every logical reason why this should be done. The transport aircraft is as essential a weapon of war as any other type, and is no less essential than aircraft carriers, cruisers or other warships, which are "stored" in reserve in considerable numbers."

AIRFIELD OWNERS FOREGATHER

THE annual dinner of the Aerodrome Owners' Association was held on Thursday of last week at the Hyde Park Hotel, London. Alderman Colonel R. Mould-Graham, O.B.E., M.C., T.D., the chairman, presided.

In proposing the toast of the Association, Mr. J. D. Profumo, O.B.E., M.P., Parliamentary Secretary to the M.C.A., disclosed that his Ministry was to be combined with that of Transport, but that the Government was, nevertheless, determined to do all it could to foster civil aviation. Furthermore, he said, they appreciated full well the past services of the A.O.A. It was clear that —with rotorstations likely to spring up in towns all over the country—the future well-being of the Association was assured.

Mr. Profumo went on to say that he was sad at the necessity for closing the Reserve flying schools (though he could add that B.I.A.T.A. was doing all it could for the instructors who found themselves without jobs); he was also very disappointed at the response to the Firms' Flying Clubs scheme.

Colonel Mould-Graham, in replying, said that A.O.A. membership now stood at 70, and that municipalities had already been asked to locate sites for rotorstations.

Mr. Whitney Straight, C.B.E., M.C., D.F.C., next proposed the toast of Civil Aviation. Running an airline with converted bombers, he said, had been like trying to operate a bus company with tanks: but now the Comet was here, and the Britannia visible on the horizon. He paid tribute to the Brabazon Committee and to that of Lord Knollys, whose foresight had made the present situation possible. B.O.A.C., he said, was in favour of charter companies operating—with efficient aircraft—provided uneconomic overlap with the Corporations was avoided.

Responding, The Hon. B. L. Bathurst, Q.C., chairman of A.B.A.C., remarked that his association was concerned with the operation of the Reserve Schools and the industrial scheme as well as the flying clubs; the latter were just getting on their feet again after the war. Nothing could be done, however, without airfields, and if (as seemed likely) many of them had to close as a consequence of the recent decision over the Reserve Schools, a very serious situation would arise. Once an airfield was closed, it was likely to be lost to flying for ever.

The toast of the Guests was then proposed by Mr. C. M. Newton, a past chairman of the Association. He further underlined the importance of non-State-owned airfields by reminding his audience of the part which they had played, when requisitioned, during the last war. A scheme had been devised at Ringway whereby the operating expenses of the airport would be shared between Manchester Corporation (the owners) and the M.C.A., and he would like to see more of this sort of thing.

The last speech of the evening was the reply by Mr. G. R. Ward, M.P., Parliamentary Under-Secretary of State for Air. He said that the Air Ministry had taken the decision to close the flying schools with extreme reluctance and because of two main considerations, one economic, the other practical. Economically, the means available were sufficient only to develop the most essential defence needs; from the practical point of view, it was not possible to train the pilots of a modern air force on light aircraft operated from grass airfields. He would like to emphasize, however, that the Ministry felt real concern for the instructors deprived of their livelihood, and was doing all it could to find them alternative employment. Many had already been suited.

A REVISED SHAPE

ON February 27th, General Ridgeway's headquarters announced that the NATO Standing Group in Washington was considering a recommendation for a unified command in Central Europe and "an enlargement of the functions of Air Deputy at Supreme Headquarters." It is expected that, under the new arrangement, General Norstad will succeed Air Chief Marshal Sir Hugh Saunders as Air Deputy.

Sir Hugh, who completes his two-year term at SHAPE this spring, has been somewhat handicapped by having incomplete access to American atomic data; General Norstad, being an American, would not be similarly restricted and would probably have wider terms of reference. (Incidentally, the post of Chief of Staff of the U.S.A.F. falls vacant when Gen. Arnold retires this summer; Gen. Norstad is a likely candidate.) Gen. Norstad's present post may be filled by a British officer, and Sir Basil Embry's name has been mentioned in this connection.

NEW MISSILE RANGE IN AUSTRALIA

SALISBURY, a village near Adelaide, South Australia, has been selected as the site for a field trials centre for the testing of rockets and guided missiles developed by the Hawker Siddeley Group. The principal Group partner in this work is Armstrong Whitworth, at whose Coventry factory rocket and missile work has progressed steadily since 1945.

On Friday last, February 27th, a joint British/Australian team, led by Mr. R. J. Woodhams, A.F.R.Ae.S., M.I.A.S., left for the new establishment, where launching ramps, electronic gear and calibration and test equipment is now being installed. Commenting on their departure, Mr. H. M. Woodhams, managing director of Armstrong Whitworth Aircraft, said: "Rockets and guided missiles obviously require large open spaces for testing. There is no place in the British Isles that has the necessary climatic conditions and open range requirements.

"It is a great pity, in some ways, that the public must for security reasons remain unaware of the immense and magnificent facilities placed by the Australian Government at the disposal of the Commonwealth rocket project. Our own British Government, too, has poured time, money and effort into securing for Britain and the Commonwealth a lead in this new science."

H.D.A.'s 12,000-TON PRESS

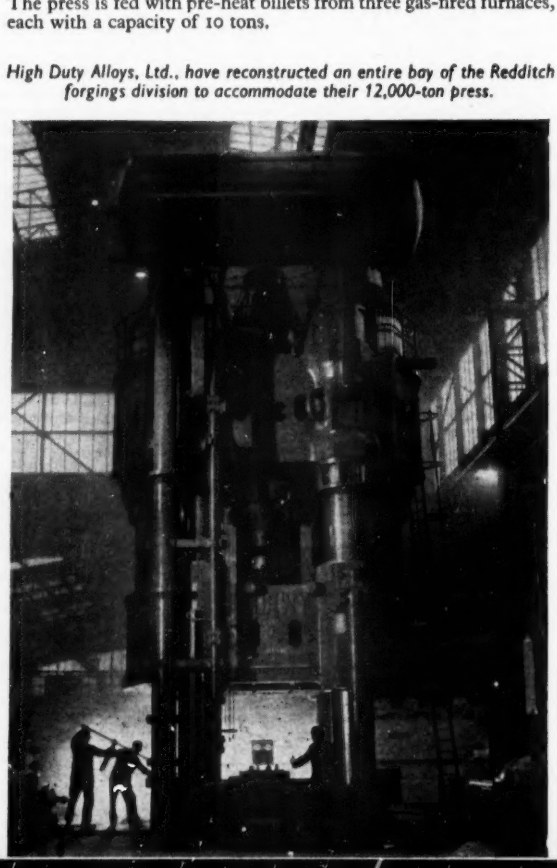
IT is generally recognized that there is a great need for presses capable of turning out light-alloy forgings much larger than any now made. Germany led the way, during the war years, in the "heavy-press technique" with machines in various sizes up to 50,000 tons capacity. Since the war, the United States has relied mainly upon German tools while her own $397 million programme of heavy-press construction gets under way.

In this country, plans for the manufacture of such tools are less ambitious, but the capacity of our industry to deliver large forgings is nevertheless, gradually increasing. The biggest single increase will come from High Duty Alloys' foundry at Redditch, where output from a 12,000-ton press was inaugurated on February 24th by Sir Frank Spriggs, chairman of the company and managing director of the parent Hawker Siddeley Group.

The newly commissioned press, shown in the photograph on this page, is unusual in that, by selecting any of three hydraulic pressures, a forging force of 4,000, 8,000 or 12,000 tons can be chosen. The latter figure makes it the most powerful press on light-alloy work in Great Britain.

The crosshead is moved by three rams, of 4ft 3in bore by 15ft stroke, to which water is supplied by four pumps, each driven by a 550-h.p. electric motor. The press itself—neglecting the considerable electric and hydraulic ancillary equipment—weighs 800 tons and stands 56ft 4in high (this is, incidentally, identical with the wing-span of an Anson). Some 13ft 7in lies below ground including the hydraulic system for operating the moving table. The press is fed with pre-heat billets from three gas-fired furnaces, each with a capacity of 10 tons.

High Duty Alloys, Ltd., have reconstructed an entire bay of the Redditch forgings division to accommodate their 12,000-ton press.



HERE AND THERE

The R.Ae.S. Garden Party

THE Royal Aeronautical Society announces that its garden party this year is to take place on Sunday, June 14th, at the de Havilland airfield at Hatfield.

Suburban Crescent

THE Handley Page Victor was seen over London's north-west suburbs on Tuesday of last week. It was on its way from Boscombe Down to its maker's airfield at Radlett.

Accommodating the Comets

WORK on the new factory for Rolls-Royce (Australia) Pty., Ltd., is starting at Mascot Airfield, Sydney, this week. Employing 200, the plant will be mainly devoted to the servicing of turbojets in commercial aircraft.

Independent Services Approved

APPROVAL of the following scheduled services to and from North-West England was announced on February 28th, too late for inclusion in the table on page 314 of this issue: *Hunting Air Transport, Ltd.:* three internal, from Newcastle to Bovingdon, Manchester and Glasgow; five international, from Newcastle to Oslo and Stockholm, Amsterdam and Dusseldorf, Hamburg and Copenhagen, Luxembourg and Basle, and Paris. *B.K.S. Aerocharter, Ltd.:* two "inclusive tours," from Newcastle and/or West Hartlepool to Paris and to Basle. Each service is approved for a seven-year period, and is subject to the usual conditions.

Helicopter Forum

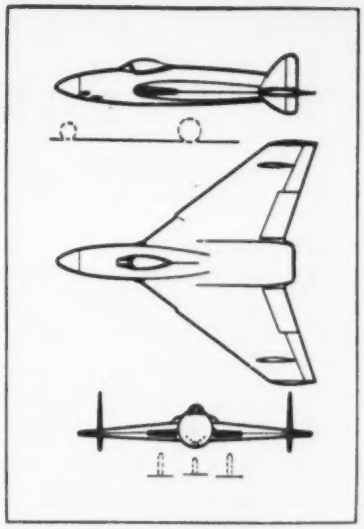
THE 1953 Forum of the American Helicopter Society is to be held in Washington from May 14th to 17th. A number of members of the Helicopter Association of Great Britain are to attend.

R.A.F. History on T.V.

A TELEVISION film similar to the current American-made *Victory at Sea*, but dealing with the war operations of the R.A.F., is to be prepared for the B.B.C. Air Chief Marshal Sir Philip Joubert is to be chairman of the committee that will make selections from official films.

Records Confirmed

THE F.A.I. has confirmed the England-Australia records made by the Canberra on January 27th. Official figures are: London-Karachi, 8 hr 52 min 28.2 sec (441.8 m.p.h.); London-Darwin, 22 hr 0 min 21.8 sec (391.2 m.p.h.). Also confirmed is the "airline" record by a Viscount on January 22nd: London-Cologne, 1 hr 10 min 17 sec (282.9 m.p.h.); Cologne-London, 1 hr 15 min 41 sec (262.703 m.p.h.).



TRIANGULAR REPORT: Since receipt of a report from the Korean area that a Russian delta had been sighted, we have eagerly awaited the inevitable "unconfirmed illustration from an unstated European source via America." Here it is. The design is attributed to designer B. I. Cheranovsky, and is said to have a top speed of over 650 m.p.h.

A.S.T. Appointment

APPOINTED director of training to Air Service Training, Ltd., Hamble, is G/C. Edward Warfield, C.B.E., D.F.C., who retired from the R.A.F. on January 17th after 17 years' service.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

R.A.F. Sabres

AT present visiting Canada, Air Marshal Sir Ronald Ivelaw-Chapman, the Deputy Chief of Air Staff, has said that the Canadian Defence Minister, Mr. Brooke Claxton, has assured him that the R.A.F. will receive its first squadron of Canadian-built F-86 Sabres during the present month.

Canada has agreed to supply the R.A.F. with a total of 400 Sabres, which are now being built in Montreal by Canadair Ltd. A first batch, which arrived in this country on January 2nd, is being used for pilot conversion and experimental flying.

G/C. Sir Louis Greig

WE regret to have to record the death, last Sunday, of G/C. Sir Louis Greig. He was 72 years of age.

Sir Louis, who was a close personal friend of the late King George VI, joined the R.A.F. shortly after its formation in 1918, after having served in France with the Royal Marines.

While he was the Duke of York, the late King was taught to fly by G/C. Sir Louis Greig and the pair were doubles partners at Wimbledon in the All-England tennis tournament in 1926.

In the 1939-45 war Sir Louis acted as personal air secretary to Sir Archibald Sinclair—now Viscount Thurso—when he was Secretary of State for Air. Last May Sir Louis was appointed a member of the executive committee of the King George VI Memorial Fund.

MAPLE-LEAF COMET: Seen at Hatfield before departure for Canada is the first of two Series 1a Comets for the R.C.A.F. The first to wear roundels, they will be used as V.I.P. transports.

New Cyprus Airfield

A REPORT from Cyprus says that the island's new heavy bomber airfield (first mentioned in *Flight*, January 16th last) is to be sited at Episcopi, in the south. The cost is expected to be in the region of £6 million.

The new airfield will adjoin an army base and will form part of the plan to build up a focal point in Cyprus of Britain's air power in the Middle East.

Hard-working Helicopters

THE nine Westland-Sikorsky Dragonfly helicopters which No. 705 Squadron, R.N., took over to Holland to help in the flood rescues, flew a total of 402 hours without either engine or airframe troubles.

A total of 810 people were rescued—80 of them by winch. F/L. Kearns rescued 147 people in one day and Lt. Cdr. Speeding, also in one day, brought out 110. The latter, on one occasion, had seven people in the cabin in addition to himself and flew with this load for 45 minutes.

The Dragonflies were also used to fly Queen Juliana, Prince Bernhard and members of the Dutch Government.

Reunion

THE annual reunion of No. 524 Squadron will be held tomorrow, Saturday, March 7th, at the Clarence Hotel, Whitehall, London, at 6.30 p.m.

On Saturday, March 14th, No. 1 S.F.T.S.(T) Ambala will hold its sixth reunion. Particulars from S. C. Booth, 70, Arbery Road, Bow, London, E.3.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Aircrew Training

THE excellent article by F. A. Chapman, entitled "Aircrew Training" (*Flight*, February 13th), has unwittingly followed exactly the same line of reasoning as that contained in letters which I addressed to my M.P. and to the Minister of Civil Aviation on January 20th.

To qualify for even the lowest-category civilian professional licence (Commercial Pilot's Licence) the applicant must have an absolute minimum of 150 hours' flying to his credit. In future, being unable to obtain this training as a National Serviceman, his only alternative will be to attend a civilian flying training school at a cost of at least £500. Precious few civilians in their mid-twenties can afford this £500, hence there will be an acute shortage of civil aircrew in the very near future.

The only solution is the formation of a National School of Aviation, from which the civil airlines could "purchase" aircrew, and the School could also be subsidized by the pupils themselves agreeing to repay part of the cost of their training by contributing 5 per cent of their first five years' salary.

Both the staff and the equipment are already available in the "axed" schools, hence the initial cost will be negligible providing the scheme is put into operation immediately. If, however, the scheme is delayed, the equipment will deteriorate and the redundant instructors will return to civilian jobs, where their attitude will become "once bitten, twice shy." They will never be tempted back into flying again. I *know*, for I am one of them!

R.A.F., Kirton-in-Lindsey. H. G. DAVIES.

The "Saint Kevin" Accident

IN *Flight* for February 6th Capt. R. N. White of Aer Lingus criticized several of the points made in my article "Airflow over mountains" in the issue of January 2nd. May I reply, firstly on four points of detail?

(1) Capt. White suggests that I jumped to several conclusions and stated "without qualification, that the probable cause of the accident was 'the encountering of a powerful downcurrent of air on the leeside of Snowdon which forced the aircraft down into an area of very great turbulence.'" It should be made clear that I was quoting the Court of Inquiry in answer to the Attorney-General's question "What was the probable cause of the loss of the aircraft?" The answer, too, was without qualification.

(2) "An aftercast of the track made good by the *Saint Kevin*, produced by M.C.A. and reproduced as Fig. 2 in Mr. Yates's article . . ." I assure Capt. White I had seen no M.C.A. map and drew this myself to show the wherabouts of the places mentioned.

(3) Capt. White asks if "Mr. Yates is being accurate or fair in talking about 'unexplained errors in navigation.'" I quote the Attorney-General's question No. 7 and the Court's answer. "7. In what respects, if any, was the navigation of the aircraft unsatisfactory?—The navigation of the aircraft was unsatisfactory in that it took the aircraft to a position close under the lee of Snowdon at a time when the Captain believed that he was coming out over the Irish Sea."

(4) Capt. White feels "obliged to repudiate the suggestion that the *Saint Kevin* commenced a descent from 6,500ft to 4,500ft before receiving clearance." I had not intended to suggest that Capt. Keohane did so. He requested a descent clearance and *it was given* by Dublin. I agree that the fact that no acknowledgment was given by the *Saint Kevin* may mean that disaster had already occurred at 6,500ft.

The purpose of my article was to draw the attention of pilots who have to fly regularly over mountains to the characteristics of the lee waves which those of us who fly gliders in these districts have discovered. I had no reason to disagree with the findings of the Court that the accident was caused by "a powerful downcurrent of air on the leeside of Snowdon"; I sought to explain the conditions under which these downcurrents are known to exist. (A few days after the article was published, the Ministry of Civil Aviation issued a notice to pilots with the same intention.) My explanation did not differ from that outlined by the Court in para. 53(a) and assumed, in accordance with the Court's findings, that the pilot was in the lee of Snowdon when he thought he was over the sea.

Capt. White "finds it easier and more logical to accept all the R/T. reports received from the *Saint Kevin* than to doubt them—even if they conflict with meteorological theory." Well—none of us really knows what happened to the *Saint Kevin*, but let nobody imagine that these standing waves are just meteorological theory. They are very real indeed, as dozens of pilots who have flown in them and measured them can testify. Let us learn our lessons the easy way!

College of Aeronautics, Cranfield. A. H. YATES.

IN search of information about airflow over mountains, I was reading the article by A. H. Yates in your issue of January 2nd.

The following point occurs to me concerning the theory of standing waves. For "aerodynamic" flow the results seem to indicate that there would be a drop in static pressure at the wave-crest, such as to cause a pressure altimeter to over-read for any given height. What would be the results for various types of stable air, at various speeds, and with speed varying against height?

I am unable to discover any experimental results relating to this problem, and as it is one affecting air safety I think something should be done. If anyone has a suitably equipped aircraft, I will give as much time, and do as much flying as may be needed, to solve at least part of the problem.

London, S.W.18. GORDON H. LONGWORTH.

THE INDUSTRY IN BRIEF

ON February 24th, H.R.H. the Duke of Edinburgh visited both the Brentford and the Feltham factories of the Sperry Gyroscope Co., Ltd., where he saw in production the latest instruments in the company's range of aeronautical and marine equipment. Throughout the tour—to which we hope to make further reference next week—the Duke showed a deep knowledge and understanding of technical matters.

* * *

Trading results of the English Electric companies, announced last week, showed a group profit of £4,359,034, as against £3,642,141 in 1951; taxation absorbs £2,909,516. Profit of D. Napier and Son, Ltd., rose from £318,561 to £322,436 and that of Marconi's Wireless Telegraph Co., Ltd., from £331,381 to £576,704 (of which £384,527 goes for taxation).

* * *

The 1953 Ignition Conference is to be held at the Savoy Hotel, London, on April 22nd-23rd, with A. Cdre. F. R. Banks as chairman. Lodge Plugs, Ltd., Rugby, are the organizers.

* * *

An exclusive licence for the manufacture and sale of Napier toggle- and stud-type cowling fasteners has been granted to Aero Controls, Ltd. These fasteners, which conform to Spec. D.T.D.(R.D.1)3,006 and Provisional Spec. D.T.D.(R.D.1)3,007 respectively, will, in future, be known as the Aero Controls "N" type toggle fastener and "N" type stud fastener; enquiries regarding them should be addressed to Aero Controls, Ltd., Industrial Estate, Weedon Road, Northampton.

* * *

The head office of the Associated Ethyl Co., Ltd., is now at 20 Berkeley Square, London, W.1 (Grosvenor 6030).

* * *

The first National Factory Equipment Exhibition is to be opened at the Royal Horticultural Hall, London, on March 23rd. Exhibits will include mechanical handling equipment, costing and accounting systems, safety equipment, protective clothing, automatic tools, dust-removal systems, and welfare equipment.

* * *

Bakelite, Ltd., announce that their travelling exhibition of plastics is now on view at Portsmouth (Chamber of Commerce Hall, Swan Street), until March 7th. It will be at Bristol (Royal Hotel) from March 17th to 21st. The "shell mould" casting process is among the exhibits.

* * *

Hall and Hall, Ltd., Oldfield Works, Hampton, Middlesex, state that they can now supply their "Phiberoid" jointing material to Spec. D.T.D. 776. In addition, they are manufacturing a very complete range of "Hallprene" "O" rings to Spec. B.S.S. 1806/1951; these moulded rings are described, and their action under pressure illustrated, in a leaflet issued by the company.

THE YEARS AHEAD . . .

the ever-present consideration of Rolls-Royce

The Vickers Viscount. Four Rolls-Royce "Dart" engines.

The Vickers Vimy. Two Rolls-Royce "Eagle" engines.

BY CONCENTRATING ON DEVELOPMENT — and still more development — Rolls-Royce have made progress. This has continued from the early "Eagle" engines to the gas-turbine engines which power the latest aircraft of today. Rolls-Royce development goes on with the future ever in mind.

ROLLS-ROYCE

Aero Engines

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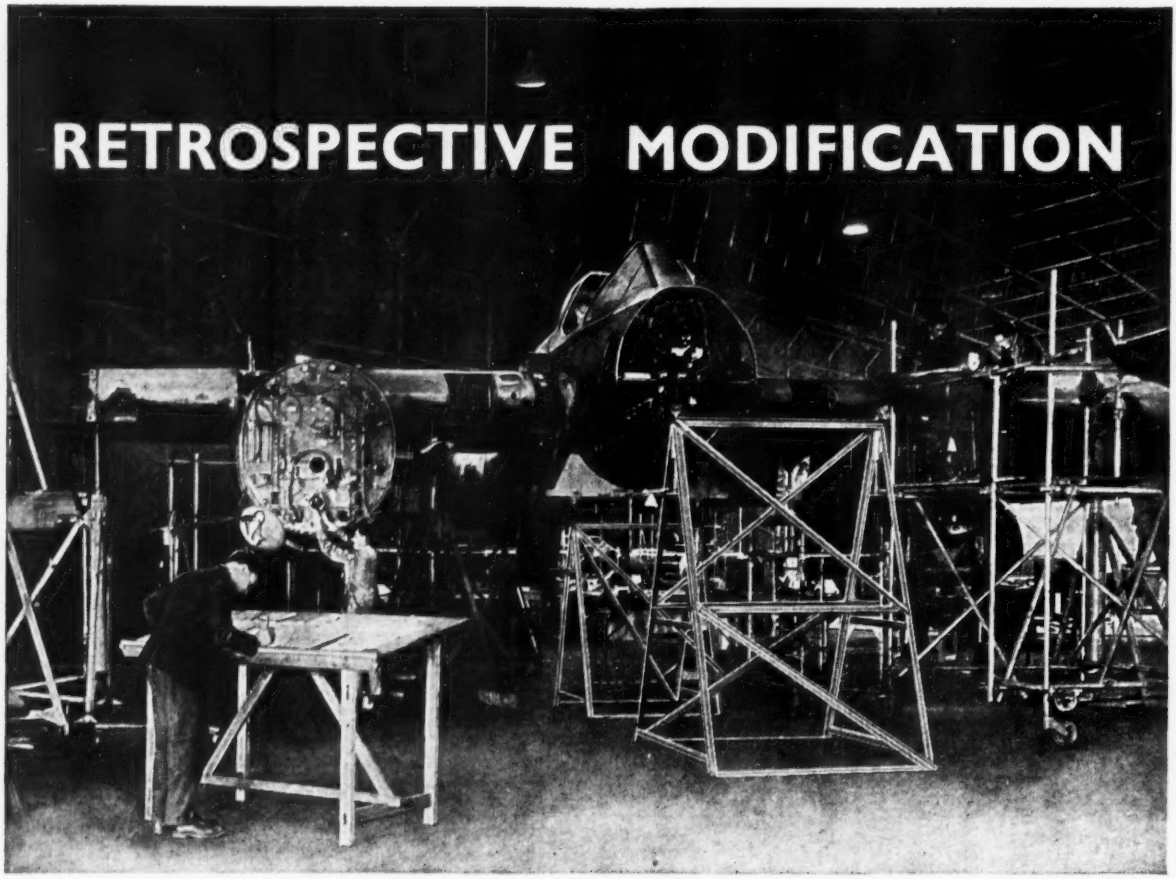
RETROSPECTIVE MODIFICATION



We at Flight Refuelling Ltd. offer complete facilities for retrospective modification, from design through to flight test, on all classes of aircraft. Our comprehensive experience of aircraft engineering, extending over 20 years, and the wide range of our technical resources, entitle us to claim that a conversion by Flight Refuelling is second to none. Send us your enquiries for all types of work on aircraft.

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MAJOR OVERHAULS

Contractors to the Ministry of Supply and leading aircraft manufacturers, we undertake major overhauls and repairs on aircraft of every type, both British and U.S. The high standard of an F.R. overhaul is our particular pride.

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AIRFRAME COMPONENTS

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INSTRUMENTS AND RADIO

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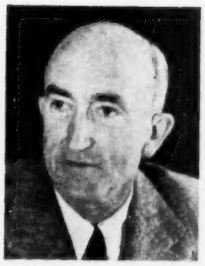
THE CONSTRUCTOR'S VIEWPOINT

Executives of Five Nationalities state their Opinions for "Flight"



From WILLIAM M. ALLEN, President, Boeing Airplane Company.

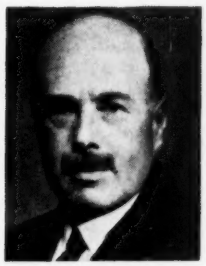
THE intention of the Boeing Airplane Company to design and build, with its own funds, a prototype jet transport, was one of the important decisions made by the company during 1952. We are of the opinion that we can build a test vehicle which will enable us to demonstrate to the military the principal characteristics of a combination tanker and jet transport and, at the same time, demonstrate to the airlines the principal characteristics of a production jet airliner.

From the standpoint of military security, we feel that the development of a jet tanker and transport is essential. Furthermore, it has long been our view that American manufacturers should develop commercial jet transports as soon as it was economically feasible to do so.

The prototype will be a large, new type, jet-powered airplane incorporating many engineering advancements Boeing has developed and proved over the past several years. It will be a demonstrator model, the basic design of which will be adaptable to two production models: first, a versatile military airplane for aerial refuelling of fast jet bombers and fighters, and for cargo and troop transportation fitted to the tempo of jet-age military tactics; second, a high-speed, economically operating airline transport for passengers and cargo.

Design and manufacture of the prototype will require an expenditure of company funds in excess of 15 million dollars. We are entering a field in which we will have severe competition. The undertaking follows naturally, however, from our experience in the application of jet power to large aircraft.

Designing, building and flying the B-47 Stratojet bomber and the new B-52 eight-jet Stratofortress heavy bomber have given Boeing an unparalleled background of experience. It has included, for example, 14,500 hours of jet wind-tunnel research and more than 5,000 hours of test and research flying. The Boeing Company is taking positive steps to apply this wealth of experience to advancement in the field of air transportation.



From SIR WILLIAM G. VERDON SMITH, Chairman, Bristol Aeroplane Co., Ltd.

THE spectacular performance which the gas turbine has conferred on air travel has indirectly led to a great deal of unrealistic prophecy as to the form commercial aviation will take. By common consent, an immense future is envisaged for commercial aviation. One should not, however, lose sight of the fact that the operative word in the term is "commercial." If this sort of aviation is ever to be a profitable business, it warrants businesslike handling. The governing principle for the commercial form of aviation must surely be that which rules all other trading enterprises: how much is to be had in return for a given expenditure.

For airlines this means the revenue they can expect from the operation of given types of aircraft: a matter of the prime cost of the aircraft plus spares, the amortization period, the performance capacity of the aircraft, and its operating costs. These are the direct factors; others, such as route applicability, traffic potential, competition and so forth, are indirect factors which also have to be taken into consideration.

The gas turbine has made great speeds possible and has smoothed away fatiguing vibrations; it has outmoded the piston engine. But it is erroneous to identify the gas turbine exclusively with the jet aircraft. By using a turbine engine to drive a propeller, the smoothness of the turbine is retained, together with the great power it gives for small size and weight, while the fuel consumed is drastically reduced.

We at Bristol have proceeded with the development of the turboprop engine because we have long been convinced that the economy it offers cannot be disregarded by airlines.

In order to show the ability of the turboprop it is obviously necessary to measure it against a competitor, and the competitor everyone is interested in today is the jet airliner. The one quality the jet aircraft has in advantage over the turboprop is speed. But the speed difference between them is not, in fact, so large as many people imagine. Certainly it is not enough to offer the traveller a great attraction in the way of time reduction, particularly if he has to pay more to travel in the jet aircraft, and as time goes on the speed difference between the two types will diminish.

Inherently, the turboprop consumes much less fuel than the turbojet, so for a given range the turboprop aircraft need carry less fuel, or for a similar fuel load has a greater range. For the same payload and range performance, therefore, the jet aircraft must necessarily be larger and heavier than its turboprop counterpart, with all that this entails operationally and financially. It can, in fact, be claimed that the direct operating costs of the turboprop airliner are roughly half those of a turbojet aircraft for the same payload/range performance. On a hard commercial basis, this must inevitably tell.

W. G. Verdon Smith.

From JOHN JAY HOPKINS, Chairman and Managing Director, Canadair, Ltd.

DURING its 50 years of rapid growth, the aviation industry has remained as young and fascinating as ever and it seems that there are inexhaustible possibilities for further improvements and perfection. Canadair's contribution to this development has thus far been largely in the field of aircraft production, and we take particular pride in our record of meeting delivery commitments.

During World War II, we built more than 350 Canso amphibians. In the post-war period, we converted approximately 350 Douglas C-47s to commercial DC-3s before we entered into the building of some 70 four-engined airliners of the North Star and Argonaut types.

Since the outbreak of the Korean War, our facilities have been entirely at the disposal of the Canadian Government for the building of military aircraft of several different types. In addition, an important extension to our programme may develop as a result of studies that are presently being made of a large four-engined aircraft, suitable for long-range reconnaissance work.

Throughout this post-war period, Canadair has not lost sight of the civil market. During 1952, we made a thorough investigation of the short-haul market and have subsequently come to the conclusion that there is a substantial air traffic potential on these routes that is still waiting to be exploited. To meet these and other demands, it is essential that any new type of aircraft, if it is to be successful, should represent technical and economic progress. In addition, timing on a project of this nature is very important. Aircraft designers, to a certain extent, have to be clairvoyant when it comes to meeting the demands of the future and having aircraft available for delivery when they are needed by the industry.

As a result of the company's survey into the requirements of the short-haul operators, our engineers have designed a conventional twin-engined, 32-passenger aircraft capable of meeting this specific demand of this type of operation. Our world survey has also shown that a good commercial aircraft lives much longer than is usually assumed. Airlines do not scrap a machine just because new and improved types become available. They either modernize them, retire the aircraft to less important services or sell them to some other operator.

Filling all these requirements is no small order for a private company, but we believe that Canadair, with its modern production facilities and experienced personnel, will play an important part in the growth of future air transport.

John J. Hopkins

From FLOYD B. ODLUM, Chairman, Consolidated Vultee Aircraft Corporation

AS we look back from the fiftieth anniversary year of powered flight we would conclude that progress and civil aviation have been essentially dependent upon the engineering advances which have resulted in today's modern transport aircraft. These advances have been great and much credit is due to the inspiration of our scientists and engineers who have made these advances possible. Air transportation has grown to the status of major industry which has a direct or indirect influence on all of the world's inhabitants.

The much-discussed question today relates to the next advances that will be made in providing new aircraft with which to fly the world's airways. We will continue to engineer new transports that will further the development of the air transport system.

To my view, the engineering of tomorrow's transports is no longer the matter of engineering alone in its strictest sense. It must start with the concept of financing, and sound financing can be based only on sound economics. The history of the introduction of new equipment has always been one in which the new aircraft replaced the old, not only because of the improved speeds and comforts provided but also because of lower unit operating costs in terms of payload carried. This lower cost followed naturally, because the engineering advances which yielded the new equipment were based upon the fundamental improvement in the efficiency of the aircraft themselves, thus automatically providing improvements in economics with the improvement in performance.

As we reach into the jet age we are talking about something very different. The question of overall efficiency becomes of prime importance; full consideration must be given to all factors of cost.

In order that there be no misunderstanding of my remarks above let me state flatly that I am a firm believer in the future of the jet transport aircraft. But I am saying that its introduction into the air transport systems of the world must be made on a sound economic basis which carries with it the technical advances that further improve the speed and comfort of air travel. We cannot rest on the speed and comfort improvements alone.

To me, the engineering of tomorrow's transports has a broader connotation than the question of design alone. The whole impact of new jet, turboprop or other types must be measured and anticipated clear to the end, including the financing. The most severe blow that could be dealt to civil aviation would be that it would fall into the category of complete and absolute dependence upon Government subsidy and support. If it is to advance to its ultimate target, and I have complete faith that it has that ability, it must increase its ability to support itself on the basis of the services it is capable of rendering.

Floyd B Odlum

From SIR GEOFFREY DE HAVILLAND, Director and Designer of Aircraft, de Havilland Aircraft Co., Ltd.

THIS Commercial Aviation Number of *Flight* appears at the time when gas-turbine aircraft, both pure jet and propeller-driven, are becoming established and accepted. The introduction of the new forms of power unit coincides with the international agreement on tourist-class fares. The main-line aircraft has achieved in one step a notable advance in speed, and it seems that it will next be considerably increased in size.

It is unwise to indulge in forecasts, but an opinion might be risked that transport speeds above 600 m.p.h. are some way off. If this is so, it is due to economic rather than physical limitations. Jet travel, already highly competitive as to cost, will become substantially more economical with the next advance in aircraft size. In short, larger loads at speed appear to offer a path to economy more attractive than the employment of slower vehicles.

The difficult task of adapting transport organizations to the higher speed of the new aircraft might well have daunted operators, and it is remarkable how quickly the first user of jet airliners, B.O.A.C. has been able to assimilate these changes into its operations.

The main requirements are what they have always been—safety, comfort, reliability and economy. These characteristics must be combined with the highest speeds that are compatible with them, and the ranges obtained must be such as will allow high speeds to be advantageously exploited.

British civil aviation has made good the first phase of its post-war revival. Thought and action must be on a large scale to secure the second stage of the task.

Geoffrey de Havilland.

From DONALD W. DOUGLAS, President and Chairman, Douglas Aircraft Company, Inc.

THIS first half-century of powered flight truly has been fifty years which changed the world. When one reads of jet crews crossing the Atlantic for lunch in America and arriving back in London for tea, he begins to realize how tremendous has been the progress of aviation since that first faltering flight in 1903 at Kitty Hawk.

Air power, as we know it today, has altered the whole course of human destiny. It has revolutionized the techniques of warfare and become a balance of power between nations. It has advanced world economies perhaps by centuries and its final effects upon governments and peoples are likely to be so profound that we can scarcely imagine, much less appreciate, them now.

As an example of the great commercial expansions that have taken place since war's end, our own company has received orders totalling 433 for our DC-6 transport since the series was introduced in 1946. In 1952 alone we received orders from 15 foreign and domestic airline operators calling for delivery of 114 four-engined transports of the DC-6 and DC-7 type. Of the latter highly advanced model, with top speed of 400 m.p.h., we now have orders for 58.

These indications, from only one American manufacturer, appear to me striking evidence that in commercial, as well as in military, aviation progress in our respective countries will continue at an ever-accelerating rate.

As we approach the age of jet transport, your own aviation efforts and accomplishments are bringing great credit to British engineers, craftsmen and technicians who are pioneering in this field. Your achievements have been outstanding.

I am confident that we, in America, can and will contribute significantly to these accomplishments in the next few crucial years. As the jet era advances, all of us will remember and pay tribute to the great nation whose early researches and fulfilments have made aviation history.

Donald W. Douglas

From SIR FREDERICK HANDLEY PAGE, Chairman and Managing Director, Handley Page, Ltd.

THE major airlines of the world are now tapping a vast new market. The introduction of "air-coach" services has revealed what a great potential field there is for passenger air transport at these lower rates, and operators are exerting every effort to satisfy it.

Many, however, are handicapped by their equipment which, although much developed, is in some cases nearly fifteen years old in conception. High-density versions are filling the gap nobly, but operators are looking hopefully to the future for the harvest which forthcoming airliners will give. In planning the re-equipment of their fleets at the present time, when technical progress is so rapid, they are faced with the problem of choosing the aircraft which fit into future route and traffic patterns and before the relative rôles of piston-, propjet- and turbojet-engined types are determined clearly.

There are, of course, indications of main-line trends. B.O.A.C.'s successful pioneer operation of turbojet airliners points to luxury travel on the world's air routes being of this character in future. For the all-important tourist traffic, particularly for the shorter ranges, piston and propjet types will compete and these will have the advantage of greater economy. Future requirements for feeder

services are clear: a vital need of sturdy, low-cost aircraft which will replace the faithful, but antiquated, present equipment and operate faster and more cheaply with greater safety. In fact they will meet the exacting present-day airworthiness requirements which so many of the older types fail to satisfy.

As for technical developments, landing and take-off speeds in future must be stabilized or reduced. As well, in order to have really cheap long-range flight, drag must be decreased. Both these aims can be achieved by different applications of boundary-layer control, a technique for which I see a great future.

All plans for forthcoming civil production are governed by the threat of war and military commitments. At Cricklewood, our eyes are turned towards a peaceful future and the provision for main-line routes of an intercontinental jet-liner, the crescent-winged H.P. 97, capable of three Atlantic crossings in a day. We have plans in other directions, too, but at the moment I can say nothing concrete about them.

From ROBERT E. GROSS, President, Lockheed Aircraft Corporation.

IN common with other airplane makers in America, I look forward to at least two years of substantial activity and production in our field. This, of course, envisages no drastic change in our foreign policy which, if any should transpire, would of course affect the programme accordingly. I think it is fair to observe that the make-ready phase of our American programme that was put in right after the outbreak of the Korean incident is now completed, and we are attaining the rather impressive production totals that were set up for us.

As one who has been interested not only in military types but in the commercial field as well, it seems pertinent to comment on the position of the American manufacturers as opposed to British and European makers in the field of advanced turbine-powered transports. Many have wondered why there is apparently such a wide gap in point of time between our development programme in this country and, for example, the British industry's present position. There seems to me to be very good and justifiable reasons for this difference of position and I think it fundamentally stems from two facts: one, that the baseline of American transport design is the requirement of the successful airline operators; and two, the lack of government assistance to United States manufacturers.

Regarding point one, the economically successful airlines throughout the world, and especially those facing strong competition with little or no government aid, have been using United States designed and manufactured equipment practically exclusively. Because the United States designs are based on good economic principles, our transports have been profit-generating machines. While a great deal of our attention has been given to the present and immediate future requirements, we have not, in any sense, lost sight of our obligations to the future. Indeed, quite the contrary, for our experiences and knowledge of airline requirements have served to convince us even more, if that is possible, that our new designs must also be founded on the bedrock of good economics. We are determined that our jet transport will have positive earning economies under normal airline operating conditions. In plain language, the United States operator has, after 25 years of gruelling hard work, discovered that the present state of the art in transport design can make money for him, and we feel as manufacturers that it is incumbent on us to produce equipment that will maintain this profit, if not increase it.

Regarding the lack of government assistance, I must point out that the United States airframe manufacturers producing commercial transports have lost close to a quarter billion dollars since the war. That we sustained these losses during a period when we were at the same time delivering equipment which has positive earning characteristics only serves more forcefully to point up the fact that we cannot afford to be wrong on the choice of a new commercial design. The financial risks—in our case private risks—are so large that we must be absolutely right on every one of many important design features. The development work that we have done and are doing in our company has convinced us that the economics of the jet transport are more sensitive to design changes than any other type we have investigated. In the face of new data coming to light I am glad, for example, that we did not build any one of several rather tempting designs that we investigated some years ago. In short, we cannot afford the luxury of a poor design or of a design that is technically good but lacking in earning economics.

I do not wish to appear by these statements to in any way decry the policy of other nations or their manufacturers. Specifically in the case of the British industry, I think its effort to put advanced transports early in the field is laudable and it and its government are to be commended for their enterprise. I believe that out of these pioneering attempts will come data which will result in thoroughly practical turbine transports.

From SIR ROY H. DOBSON, Managing Director, A. V. Roe and Co., Ltd.

WHEN I was asked to contribute a few words on commercial aviation to these pages, I hesitated; I did not want to butt in on such a highly controversial subject. But, provided that everyone confines himself to facts rather than fancies and wishful thinking, there should not be much room for controversy. This applies to operators and makers alike.

The fact is that airline operators are at the cross-roads. Existing fleets of piston-engined aircraft throughout the world are becoming obsolete and policy decisions on their replacement have to be made. Britain took the lead by producing the world's first turbine-engined passenger-carrying aircraft. Not only have we built them, but we are operating them, and operating them at a profit. This has given our American friends a shock, and even today they are inclined to treat this British success with scepticism. They doubt our ability to make these aircraft pay their way, but, as our fleets of turbine-engined aircraft increase, the American operators show signs of becoming seriously worried. The U.S. manufacturer, on the other hand, is anxious to secure orders for jet passenger aircraft, but the anticipated cost of building prototypes without guarantee of firm orders from the airlines is frightening him off.

For some years now we of the British aircraft industry have been ceaselessly engaged on developing efficient long-range aircraft capable of carrying big loads. Intensive study, research and development into fuel economy, low drag, robustness and simplicity has gone on. With valuable contributions from the engine firms we have succeeded in producing aircraft which have low fuel consumptions. We have achieved a very high efficiency both in airframe design and in engines, and this is amply illustrated in Britain's new bombers. Apart from three new civil turbine-engined aircraft now actually on order, the biggest advance in civil aviation will be in the derivities of these new bombers. We know that we have achieved the lowest overall drag at the altitude at which these long-range civil aircraft will have to operate.

We are at the psychological moment when commercial operators must order their long-range high-speed aircraft of tomorrow. Most of their development work has been done for them. They have the chance to take maximum advantage of the know-how that has been acquired. Another generation of commercial types—faster, more economical, and capable of carrying heavier loads over longer distances than anything we have at the moment—is ready for them.

Never before in our history have we been able to offer such efficient aircraft in this particular field. We know that we are in advance of anything in the world today; but, in respect of performance and cost, aircraft capable of travelling non-stop between New York and Paris, Karachi and London, more or less regardless of weather conditions, can be offered with the greatest of confidence. They will carry upwards of 100 passengers, plus baggage and some freight, at speeds of over 600 m.p.h. We know, moreover, that they will do this at an operating cost of very little more than one halfpenny per passenger mile. So the old argument of economy is eliminated.

Today there are good turbojet aircraft operating very satisfactorily. We have had a taste of the benefits they can bring. But, good as they are, they are not comparable with those that *could* be in service in five years time—if somebody ordered them now. If the old arguments go on, the aircraft will never get ordered and will never be built.

I repeat that the intensive and exhaustive development work that has been carried on in this country for the last five years is a most valuable asset. Its benefits can be picked up for nothing by the world's commercial operators.

From H. C. VAN MEERTEN, Chief Designer, Royal Netherlands Aircraft Factory (Fokker).

IT seems evident that civil aviation is still in its youth and that considerable progress lies ahead. The greatest obstacles in reaching a general public acceptance of aviation as a normal means of transport are, in the first place, its reputation with regard to safety and in the second place the continuing unreliability under adverse weather conditions.

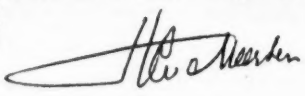
The first obstacle can be overcome by education of the public and by improving the safety of flying, although at the moment the safety is already such that the risk of flying with civil operators is negligible. The second is more difficult to overcome, but there does not seem to be any particular technical reason why a completely foolproof system for landing in zero visibility should not be developed.

A secondary, though still rather important, factor is the cost of flying; but the history of the last decade has shown that, although prices of everything have risen considerably, the cost of aeroplane fares have fallen. With increases in the amount of traffic and improvement of the technical efficiency of aircraft, it can be expected that the cost of flying will come still closer to the cost of other means of transport.

For the moment it seems that jet engines are the best means of propulsion for long-distance work. They will lead towards higher and faster flying, although it is still too early to speak definitely of supersonic civil flying. For a stage-length shorter than 600 miles, it does not seem worthwhile to go to the high altitudes economically necessary for jet engines. Over such distances the turboprop aircraft is likely to be the most promising proposition.

For very short distances it may be that the helicopter has its advantages, especially in cases where transport by road is difficult. In general, however, the economical aspects of the helicopter make it doubtful whether, on routes which can be operated by fixed-wing aircraft, rotating-wing types can compete satisfactorily in this respect.

The Fokker Aircraft Factories have already shown their belief in the future of the turbojet engine for civil use, by early studies of a commercial aircraft; the Fokker Phantom, a model of which was shown at the Paris Show in 1946. Circumstances, however, prevented its development. In later years extensive studies have been made of civil aircraft for feederline and short-haul operation. A prototype with turboprop power, called the Fokker F.27 Friendship, is now under construction.



From GEORGES HEREIL, President Director-General, S.N.C.A.S.E.

TECHNICAL progress is, in all fields, a creator of demand. Thus, in air transport 2½ million passengers each travelled an average of 570 km in 1937; by 1947 this figure had become 21 million, with an average of 900 km; and finally by 1952, 45 million with an average of 1,000 km per passenger.

Such an increase has been possible because the aeroplane becomes progressively better adapted to the needs which it has created. The technical development which has taken place during the last ten years has not only rapidly increased speed—which remains the essential advantage of air transport—but has also contributed to a constant improvement in safety. But one can see now that air transport has become part of our habits and a method of transport like any other, because one of its essential elements today is economy. It is with this idea of economy in view that the airline companies will attract a new class of customers by their recent adoption of tourist-class traffic, which will shortly be extended to the whole European network.

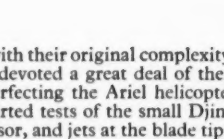
This increase in the circle of customers has its effect, in turn, on the aircraft: it steps up requirements and brings about specialization in relation to load, stage-length and the nature of the loads carried, bearing in mind the particular requirements of each route. But, on the other hand, the need for economy in the running and maintenance of their fleet leads airline operators to try to find aircraft which can be adapted for different purposes—for both passengers and cargo for example—and also to try to achieve as great a degree of standardization as possible in all units employed.

Bearing all these considerations in mind and making use of its long experience in the construction of commercial aircraft, our company, working in close association with S.N.C.A.S.O., has decided to offer to airline operators a twin-jet aircraft which, I hope, it will soon be possible for us to announce officially.

British aircraft designers have given a brilliant lead in the domain of jet aviation. It will be seen when we release our plans that Franco-British aeronautical collaboration, which our company has promoted for more than five years, will once again prove its usefulness in the cause of commercial aviation.

In another field, that of helicopters—whose use for the transport of passengers as well as for numerous other civilian purposes is beginning to expand—S.N.C.A.S.E. has likewise made a noteworthy contribution, due to the technical progress made in the course of the last few years. Quite apart from their own researches, which have had a particularly successful result in the Alouette SE-3120 three-seater, they have just set up a chain of factories through Europe for the manufacture under licence of Sikorsky S-55 helicopters, consequent upon a recent agreement with the Westland Aircraft, Ltd., of Great Britain and of the Fiat Company of Italy.

I feel that this association of the industries of Western Europe in order to satisfy the needs of the different nations for high-capacity helicopters marks an important new milestone along the road of international co-operation.



From G. GLASSER, President, S.N.C.A.S.O.

THE brilliant and speedy success of the Comet opens up the way for a far-reaching evolution in commercial aircraft. The progress of turbine machines justifies the audacious and fruitful initiative of our British friends. From now onwards they make it possible for speed and running economy to be reconciled.

S.N.C.A.S.O., who have for several years experimented with the use of turbojets for transport aircraft, have allied themselves with S.N.C.A.S.E. so as to afford that organization substantial help in designing a medium-range jet aircraft.

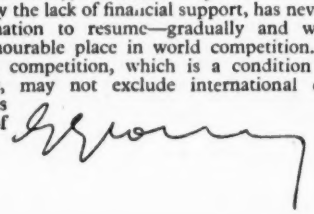
On the other hand, within a few years' time helicopters and combination and convertible machines will bring about a radical transformation in short-distance high-speed transport. They will provide a direct link between one town and another without disturbance to their load, and without loss of time in travelling to and from distant airports around big urban centres.

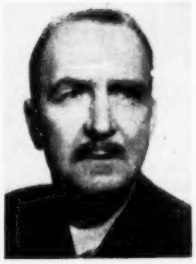
The adaption of gas-turbine power and jet-driven blades will give to these machines features of simplicity and lightness which will constitute a remarkable contrast with their original complexity.

Since the war S.N.C.A.S.O. have devoted a great deal of their research work to this field. After perfecting the Ariel helicopter with ramjet-driven rotor, we have started tests of the small Djinn helicopter which has a turbo-compressor, and jets at the blade tips. We have also completed in our workshops a helicopter-cum-fixed-wing machine and are at present studying the applications of this formula to commercial aircraft.

Finally, our Company has made great efforts to develop the French technique of using small additional jet units to improve the take-off properties of twin-engined transports.

The French aircraft industry, annihilated by the war and impeded in its recovery by the lack of financial support, has nevertheless a firm determination to resume—gradually and with strenuous effort—its honourable place in world competition. I sincerely hope that this competition, which is a condition of progress in engineering, may not exclude international co-operation, which is, in its turn, a condition of economy in production.





From LOUIS BREGUET, Managing Director and Chief Engineer, Société Anonyme des Ateliers d'Aviation Louis Breguet

THE characteristics of a commercial aeroplane must be so selected as to ensure transport with safety for the passengers or cargo at a remunerative price and adequate speed. The cost price per passenger-kilometre per aircraft metric ton, which is rather high for aircraft of small weight, decreases quickly with increasing tonnage. From a weight of forty tons upwards, this decrease becomes slower, but is still appreciable.

It seems, therefore, that the transport aircraft of tomorrow will be a machine of over 140,000 lb take-off weight with big freight holds, and which can carry 100 passengers or more in comfort over distances up to 1,250 miles—although, of course, an aircraft of half that tonnage is justified on secondary routes.

From the point of view of economy in operation, it seems that it is not expedient at the present stage of technical development to exceed cruising speeds of 500 m.p.h. Both the structure of the aeroplane and the power of its engines depend on these considerations.

For an aircraft of 140,000 lb, the fuselage capacity for cargo and passengers is such as to require a two-deck arrangement to give the necessary floor space. It is for these reasons that I first evolved the idea of my double-decker aircraft 763, of 112,500 lb weight. I then designed the Super Deux-Ponts, widened, lengthened and pressurized, and fitted with compounded piston engines of 3,500 h.p. pending the development of sufficiently powerful gas turbines either fitted with airscrews or of the ducted-fan type.

With these gas turbines and with cruising speeds in the region of 400 to 435 m.p.h., the best form of propulsion still seems to be the variable-pitch airscrew, though with the correct by-pass units greater speeds can be justified (but not without some increase in fuel consumption). The figure is half way between those for pure jets and turboprops.

With turboprops and speeds of 435 m.p.h. at heights of about 30,000 ft, specific consumptions 40 per cent below those of turbojets are possible.

Louis Breguet

From TRYGGVE HOLM, President, Svenska Aeroplan Aktienbolaget.

FLYING is, after all, business. It must imply economical advantages both for the passenger and for the airline operator. An airline passenger nowadays does not enter a plane just for "the lure of flying" or for the pleasure of spending some hours in a comfortable chair partaking of pleasant-tasting refreshments; and nobody invests money in an airline company for purely idealistic reasons or just for the pleasure of seeing his money "fly away."

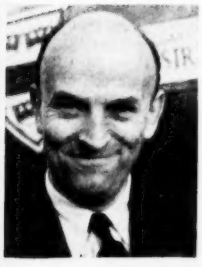
For the passenger, flying must be a rational method of utilizing his time, and for the shareholder a way of getting a reasonable dividend on the money he has invested. To realize this, aviation cannot only apply to a well-to-do minority of people, but must become available to everybody. Therefore, I regard the introduction of the tourist-class services as one of the most important milestones in the history of aviation. Tourist-class operation has now been going on for about a year and has given such good results that we are justified in foretelling a renascence in air transport.

The first condition for complete success of the tourist-class idea is, however, that adequate flying equipment is available. Within this range I think much still remains to be done, which is easily understandable : the tourist-class idea is so new that there does not today exist any aircraft type specially designed on the basis of its principles. The types now being used are all more or less acceptable modifications of aircraft types designed for "luxury" traffic. And, when determining the specifications for these aircraft, the designers have, in my opinion, been aiming too much at the best possible, as regards equipment, service arrangements and comfort (not to say luxury) items, without, at the same time, giving sufficient consideration to the economical viewpoints involved.

Immediately after the end of the war, Saab was fortunate enough to have intact production facilities at its disposal for the construction of civil aircraft, which resulted in our Scandia transport being turned out as one of the first post-war planes of its class. It flew as early as in 1946. The leading principle from the very start of the project was to build a simple, rugged, low-cost aircraft for medium-range services with a relatively moderate cruising speed, since, for the purpose of bringing about a *real* reduction of the block time over the short ranges in question, it would be necessary to increase flight speed quite considerably—which, however, would have a very unfavourable effect on the operating economy. Increase of air speed by the introduction of turboprop and turbojet civil transport aircraft is already under way, but there will still be a need of aircraft in the Scandia's class. The Scandia was, accordingly, designed to be an economical successor to the popular pre-war aircraft but with "post-war performance"; and it has also been proved to meet the requirements for an economical tourist-class aircraft, as fully evidenced by more than two years of airline service.

Unfortunately, however, from the purely civil viewpoint, when the large-scale marketing of the Scandia was about to start our production capacity had to be reserved for military aircraft. This difficulty, however, has now been overcome by the technical co-operation we have started with the Fokker works in Holland, and we are now again in a position to offer the Scandia at favourable delivery rates.

Tryggve Holm



From G. R. EDWARDS, Director, Vickers-Armstrongs, Ltd., and Chief Engineer, Aircraft Division.

THERE has been a sustained increase in air travel during recent years and the forward estimates of the world's leading airlines indicate that it is likely to continue in the years ahead. The recent introduction of tourist fares may well bring into the air many thousands of people who have previously used surface transport or may even, due to time and expense, not have travelled at all. This could produce a much sharper increase than that already expected.

The effect on surface transport is already making itself felt. The B.E.A. internal services to the North of England and Scotland have proved serious competitors to the railways. Business journeys over long distances, such as the Atlantic, are being made increasingly by air rather than by ship. It may be a pointer that one of our most important customers in the shipbuilding side of our business has ordered a fleet of cargo ships with provision for a very small number of luxury berths. The time may be approaching when ship travel is undertaken mainly for health and pleasure reasons; hard-pressed executives will fly. This is likely to be more so in the new generation brought up to regard flying as a normal, as distinct from a slightly dangerous means of transport.

Our aircraft division has worked closely with B.E.A. in producing the Viscounts 700 and 800, in order to meet the Corporation's conditions of operation. We expect to sell many of both types to the operators of the world, as indeed we are already doing. They will effectively provide a replacement for the twin-engine aircraft now in use. A longer-range version of the Viscount will probably be the replacement for the four-engined aircraft used on internal services. In the V.C.7 we believe we have a long-range four-jet transport capable of economic operation on both transatlantic and trans-continental routes.

I believe that by virtue of our lead in turbine-powered aircraft and by the lead which our Corporations will gain by operating them, Britain has an opportunity to become a great air Power.

G. R. Edwards

TRENDS in AIR TRANSPORT

An Assessment of Progress in the Technical, Commercial and Political Fields

THE pace at which air transport has developed within the past few years is clearly reflected in traffic figures published by the International Civil Aviation Organization. Scheduled airlines carried 2.5 million passengers in 1937, and 21 million in 1947. Last year's figure was 45 million; and even this impressive total does not include people carried by Russian and Chinese airlines. Another source estimates that the airlines fly 2,500 aircraft and directly employ some 250,000 people. The livelihoods of millions more are directly or indirectly related to the work of the airlines.

An aspect of air-transport development which cannot be expressed in statistics is the growing contribution which the civil aeroplane can make to social progress on a national and international scale. To quote Sir William Hildred, the airlines have "promoted trade, cut to the bone the barriers of distance, united families, disseminated ideas, and turned the last war's most devastating sword into the greatest ploughshare in history."

The current activities and latest results of the manufacturers and the operators of civil aircraft, those directly responsible for the new and important status which aviation has won, are outlined in this special issue of *Flight*. This complementary article reviews some of the many technical, political and commercial influences which are shaping civil aviation as we know it today.

Sword into Ploughshare.—War-time technical progress in the design of aircraft, made regardless of cost, greatly accelerated the advent of mass air travel, signs of which were only just apparent in 1938. A study of civil-aircraft development shows that every machine which has played a significant part in post-war development of air transport owes part of its economy and/or efficiency to one or more of the following forms of military expenditure:—

(*a*) Military production, either during or after the war, resulting in lower capital cost to the operator: This applies to the Douglas DC series and the C-46 Commando; to conversions of war-time transport types, and to direct or indirect conversions of bombers, such as the Lancastrian, York, and Stratocruiser. Post-war military contracts have also assisted several civil projects.

(*b*) Initial development of a basically civil project as a military transport: The prime example is the Constellation, which first flew in 1942 and was ready for airline service almost immediately after the war.

(*c*) Power-plant development, which is reflected in the improved performance of post-war transport aircraft, in terms of speed, range and load-carrying ability: While military engines normally feature short "life" between overhauls, particularly under combat conditions, the scale on which they are built and operated assures discovery and elimination of most of the troubles stemming from shortcomings in design and materials. Engine development, probably the most decisive factor in military air supremacy, is of corresponding importance to civil progress. When the war ended, civil-aircraft designers were presented not only with greatly improved versions of pre-war engines or virtually new power-units (e.g., the Double Wasp and Hercules), but also with the key to a new prime mover—the gas turbine.

(*d*) Associated progress in the design of airframes to fly faster, farther and higher, with greater reliability, and to carry heavier loads: These basic ends are common to both military and civil aviation, as are the means of attaining them. The extent to which military and civil requirements can be reconciled is expressed in the final form of the aircraft, the closest practical compromise—next to the dual-purpose freighter—being a bomber-design adapted to carry passengers. Well-known examples are the Viking—an interim type which has since been developed into a very economical short-range airliner—and the Stratocruiser. Normally the parts, rather than the whole, of the modern airliner embody the fruits of design-work originally carried out for less-pacific purposes. Aerodynamic progress in one important sphere pioneered by military study—trans-sonic and supersonic flight—has not yet been built into commercial aircraft, although it may well be during the 1960s.

Design, development and production of aircraft and engines, as outlined above, formed only a part of the air-transport potential existing in 1945. Some of the other bequests can be summarized as follows:—

Experience—in designing, producing, operating and flying aircraft. The new-found ability to build large numbers of complex aircraft in a short time (coupled with the existence of the necessary production facilities) is no less vital to air transport than the supply of trained crews—even though its value, particularly in Britain, is only now appreciated to the full.

Advancement of flying technique, particularly in connection with long-range and high-altitude operations; the most important proving-grounds were the great expanses of oceans. Daily crossings of the Atlantic became a reality during the war, resulting in air services which have since carried nearly two million passengers between the Old and New Worlds. More recently, Qantas Empire Airways have put war-time experience to good effect by opening a regular service across the Indian Ocean between Sydney and Johannesburg—a long-cherished aim. The evolution of pressure-pattern and cruise-control techniques must also be mentioned.

Development of radio and radar equipment, permitting safe and regular flying under practically any weather conditions. These aids, which are discussed in detail elsewhere in this issue, together constitute one of the most important factors contributing to successful airline operations. Complementary progress was made in evolving traffic-control methods suited to large streams of aircraft.

Construction of airports with runways capable of use by large and heavily loaded aircraft. Although many war-time airfields are too far from traffic-centres to have played a part in developing commercial operations, those still in use represent a public investment which the airlines alone would have found difficult to justify. A possible post-war asset is the new American strategic base at Thule, Greenland, which cost $1,260 million and is almost certainly the most expensive airfield in the world; commercial use of this base, employing Polar navigational methods developed by the R.A.F. and U.S.A.F., may provide an important new link between Europe, America and Asia.

New lines of development.—Just as countless airline operators snapped up Dakotas for as little as £5,000 apiece when the war ended, manufacturers based their design programme on the "war-surplus" developments outlined above. Their subsequent efforts fell naturally into three main categories—short-term improvement of existing designs, production of medium-term piston-engined airliners and development of a completely new generation of aircraft powered by relatively untried gas-turbine engines. For reasons which are now well known, the main British effort was concentrated in "Stage 3," allied with a subsidiary short-term programme of producing stop-gap types.

While manufacturers' products are, on the whole, matched to the airliners' requirements, there are still gaps—notably in the short/medium-range category. The DC-3 does not comply with the latest international airworthiness requirements at currently accepted weights, and special concessions have had to be granted because of the lack of a successor. There is no technical difficulty in producing one, but rather in deciding what form it should take. On busy routes with good terminal facilities its work is now undertaken by the DC-4, Martin 4-0-4, Convair 240 or 340, Elizabethan and now the Viscount. The Swedish Scandia, produced as a DC-3 replacement, has found favour with only a few operators. Canada and Holland are each building twin-engined 30-seaters—the remarkably similar CL-21 and the Friendship—for the same purpose. Airworthiness requirements, particularly in hot climates, may be met with less sacrifice of payload by a four-engined type—such as the Handley Page project reported to be under development. Large airlines now have a reasonable choice of equipment, but many operators still await an aircraft blending low capital and operating costs with good take-off performance, high payload and speed approaching 200 m.p.h. Further development of turboprops and a return to simpler conceptions may eventually provide the ideal answer to this problem. The second trend is already apparent in two highly successful British aircraft built for differing purposes: the Bristol 170 and the Heron.

Most of the world's international services have until lately been operated by American piston-engined airliners of basically similar design-formula: circular-section pressurized fuselage, nosewheel undercarriage, low wing, two or four air-cooled piston engines—normally two for short and medium stages and four for long hauls. The "stretching" process has given increased payload, range and performance sufficient to meet the demands of growing world traffic. Application of this process has centred on the Douglas, Convair and Lockheed types, with excellent results.

The position enjoyed by Britain's new aircraft in relation to these tried and developed types is reasonably clear. In the long-range group, the Britannia offers equal or better endurance, lower

THE ELECTRICAL ASPECT

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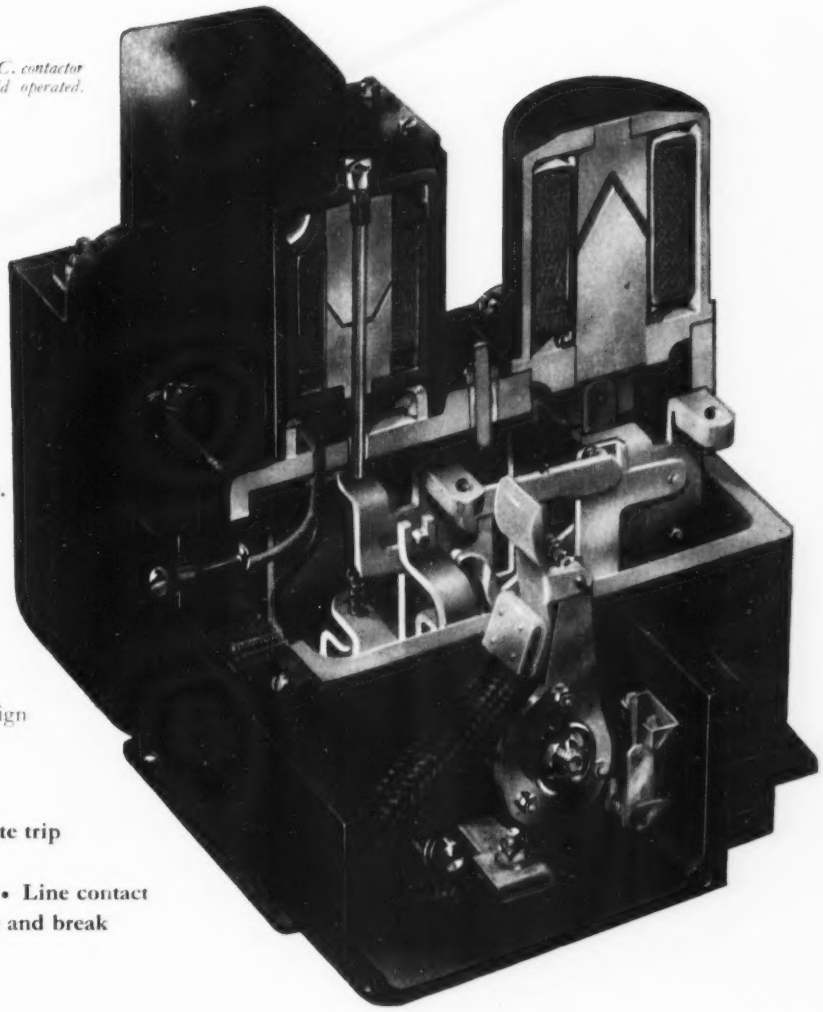

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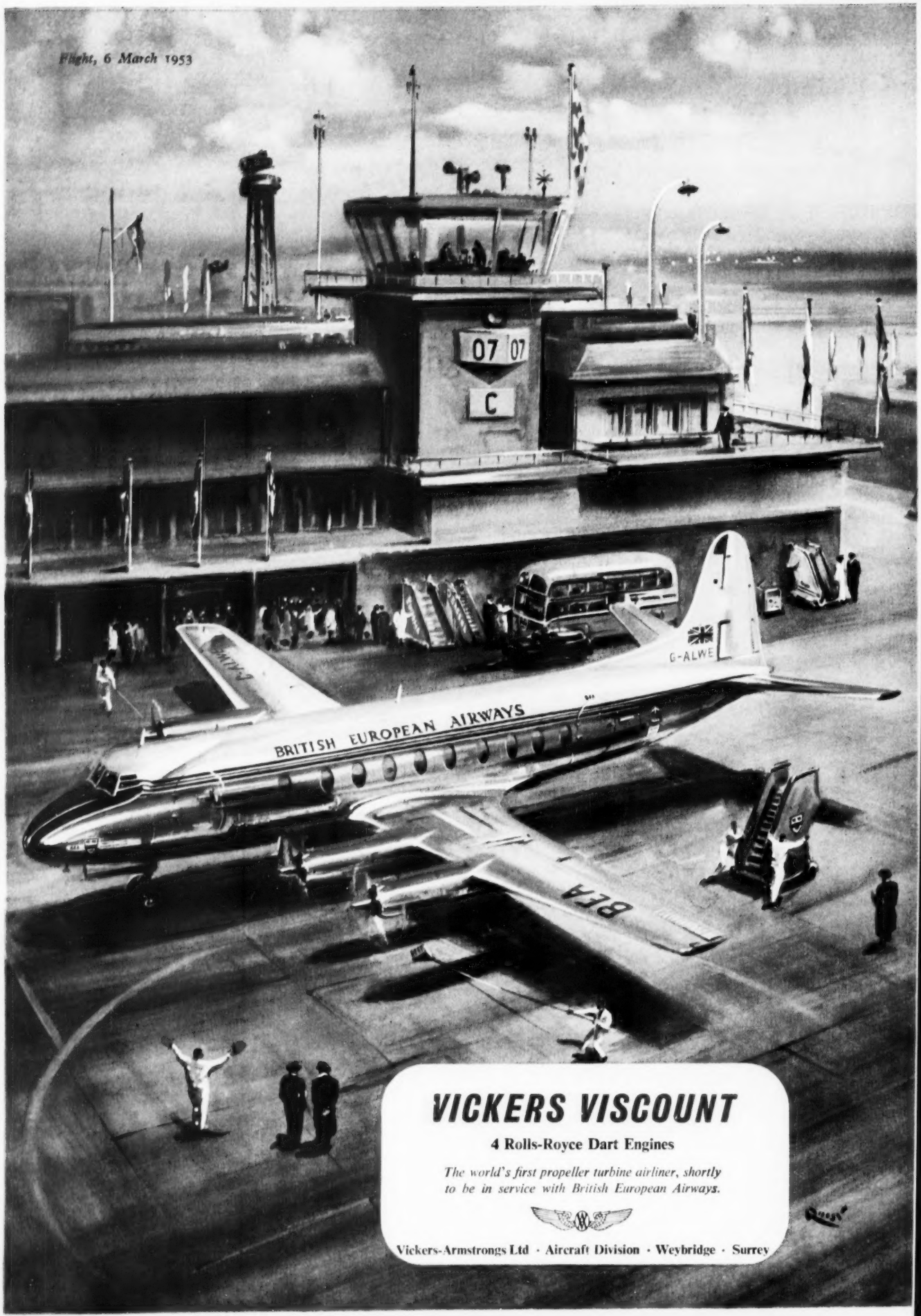

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TRENDS IN AIR TRANSPORT . . .

operating cost, higher speed and at least equal payload. The Comet, at least in present form, has a shorter range and lower payload but has a definite advantage in speed which can offset its higher cost per ton-mile on certain routes. As a medium-range airliner, the Viscount is the obvious choice for any company which has not yet bought Convair-Liners (or Martins) and whose traffic is on a scale commensurate with a unit cost of £250,000 per aircraft.

At the foot of the page we have attempted to show the degree of "stretch" embodied in leading types of commercial aircraft. British hopes of capturing the world market are based on the fact that her new aircraft are capable of steady improvement for several years ahead. Another important selling point is the relatively lower capital cost of British aircraft. Several authorities have pointed out the need for a replacement programme if the advantage is to be held, among them Peter Masefield, who wrote last year (in *Shell Aviation News*): "In the 1930s the bulk of the world's transport aircraft had a capacity for between 14 and 21 passengers. In the 1940s the size had risen to a capacity for between 27 and 44 passengers. Now in the early 1950s the demands are for aircraft of between 47 and 56-passenger capacity [for medium stages]. In the 1960s the demand inevitably will be for aircraft offering between about 70 and 120 seats—perhaps more . . . Bold decisions are needed if the British aircraft industry and British airlines are to keep to the forefront in civil aviation. In spite of the hard times—even *because* of the hard times and what these aircraft can do—we cannot as a nation afford to be without a new generation of air traders."

Two important questions remain unanswered. Is there any likelihood, as the Americans have claimed, that the lives of their existing aircraft will be extended still further by the fitting of turboprops when such units are available? Here the answer seems to lie to a great extent with the engine manufacturers, who have not yet produced a single unit suitable for commercial operation. Secondly, will the American industry permit the Britannia, Viscount and Comet, and their successors, to dominate the new era of air travel which lies ahead? Though shadowy in form and slow to appear, signs of American competition certainly exist. Boeing have announced that a jet transport "demonstrator" will fly next year; Lockheed's plans appear to be less positive, though it must not be overlooked that a turboprop military transport made its first flight at Burbank last week; Douglas, whose experience of building transport aircraft in large numbers is unparalleled, are least likely of all to ignore the challenge.

Whatever the outcome, certain definite trends in the progress of civil-aircraft design seem likely to continue, notably the inclination towards greater size. Gains in speed depend upon the relative success of the turboprop and turbojet types now entering or about to enter service. The immediate prospect appears to be use of turboprop transports for the main long-haul third-class type of service (on which the future of air transport largely depends), with pure-jet airliners offering faster, more luxurious services on selected routes. Any further inclination to the pure-jet depends largely on the potential economy of the by-pass type of turbojet now under development.

Airliners of the new generation will continue to offer the improved standard of comfort found today in the Comet and Viscount—an important but not overriding factor in increasing the popularity of air travel. Block speeds of 200-250 m.p.h. on short ranges, 200-300 m.p.h. on medium ranges and 300-500 m.p.h. on the longer-haul routes, which are now available, will probably continue to be adequate for several years. The practical value of extra speed will depend primarily on improved methods of traffic-control, weather forecasting and communications—and passenger-handling.

Spectacular increases in landing speeds and wing-loadings are improbable; the cost of airports, which is not fully borne by their users, is already a major obstacle to the development of civil aviation. The performance of future aircraft will therefore continue to be related to the dimensions of existing runways, with 6,000ft representing a high average length. Last year the city-airport relationship was the subject of a valuable study by an American Presidential Commission, whose findings indicated clearly that the twin problems of noise and hazard resulting from operations over and near built-up areas will become more severe as air-traffic expands. Better planning—replanning if necessary—of airports and study of the possibilities of the single runway system were two of the recommendations.

At present the airlines succeed in actually operating very high overall proportions of their advertised services—figures of 99 per cent have been reported—despite cancellations caused by poor visibility due to fog or other restrictive conditions. Development of the "fully automatic landing" would eliminate this loss of revenue, but opinions vary as to whether the gain would be sufficient to justify the cost. An I.A.T.A. technical conference held last May decided that improvement of the present I.L.S. system would permit safe landings with a ceiling of 100ft, which probably represented the limit of development; however, use of higher landing speeds would cause minima to be raised.

Freedom of the Air.—"The lack of an enlightened multilateral code in an important field of air transport [the exchange of traffic rights] is one of the more serious impediments to the full exploitation of the technical advances with which air transport has been presented in recent years." These words were spoken by Sir George Cribbett when he introduced his Commonwealth and Empire lecture on *Some International Aspects of Air Transport*. Although made over two years ago, this statement remains true today; and to some extent the problem is worsened by the growing ability of aircraft to link several nations in one flight of a few hours' duration.

If every nation were to agree to a universal exchange of rights, this particular problem would not exist. Such a proposal was in fact put to the delegates of 52 nations when they joined conference at Chicago in 1944 in an attempt to lay a foundation for the development of international air traffic after the war. In contrast to this suggestion—by the American delegate—was the Australia/New Zealand plan for internationalization of air services on the main routes.

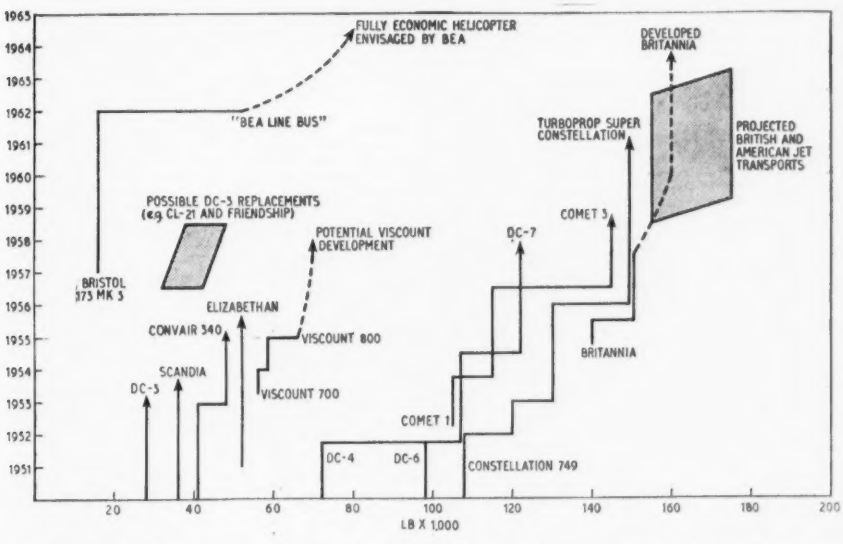
In the event, the less ambitious and more realistic British proposal for various degrees of freedom became the basis of negotiations. The degree to which the "freedoms" have been applied can be summarized as follows:—

Freedoms 1 and 2 ("innocent passage" and non-traffic landing) presented no serious problems, since they are the very least concessions which a government can grant to the airline of another nation.

Freedoms 3 and 4 concern the rights of an airline from "A" to carry passengers from "A" to "B" and from "B" to "A." Though straightforward in principle, these rights proved remarkably difficult to apply in practice until the conclusion of the famous Bermuda Agreement (between Britain and the U.S.A.) in 1946. This became accepted as the model bilateral agreement for exchange of Third- and Fourth-Freedom traffic rights between nations. Its chief feature is that, by compromise, it overcomes the main problem involved—the extent to which one partner may provide extra seating capacity on a route such as that between London and Paris. In this case, the main traffic is divided between B.E.A. and Air France, each of which may increase capacity if the other's services are not affected unduly. Bilateral agreements are, of course made between governments and implemented by operators. Sometimes the reciprocal traffic rights are not likely to be used, at least for some years—as in the case of Libya, which recently signed a bilateral agreement with Britain.

Freedom 5 is the fly in the civil-aviation ointment: the lack of any acceptable formula for granting Fifth Freedom rights (enabling an operator to carry traffic between foreign territories) is a natural obstacle to a multilateral traffic agreement. The core of the problem is the difficulty of permitting an operator to make full use of every stop on a long-haul route without taking traffic from local operators along that route. A long-range airliner may have traffic rights at some intermediate points on its route and not at others, the possible result is that several seats are unfilled for large segments of the overall journey. Without digressing into airline economics, it will at once be seen that the operator's costs per seat-mile are higher. Where nations "B" and "C" are already providing all the seat-capacity required, the only result of giving Fifth Freedom rights to "A" or "D" would be a drop in "C" and "D" traffic and a corresponding gain to the outside airline.

There are, however, cases where the granting of Fifth Freedom rights does not adversely affect local traffic, or where a long-range operator is in a position to offer attractive reciprocal rights to one or both of the



Date versus weight: Illustrating a steady increase in the all-up weight—and normally the size—of airliners built for medium and long routes. Also shown are the varying degrees to which different types embody "stretch" (indicated by a step to the right). Each basic type is represented by a line beginning at the estimated or actual date of introduction to regular service. The arrow head at the top of each line implies that no attempt is made to prophesy the useful life of any particular type.

TRENDS IN AIR TRANSPORT . . .

intermediate countries from whom it seeks local rights. Arrangements of this kind can be and are made (it was observed in last year's I.C.A.O. report that a large proportion of bilateral agreements filed in 1951 made "liberal provision for . . . the carriage of passengers, cargo and mail between points outside the territory of the State whose nationality the aircraft possesses"). It is particularly difficult for a compact country such as Holland, with little to offer in return, to obtain the traffic rights essential for economic long-haul services. Since these agreements are bilateral, they obviously circumvent the basic problem; the process of assuring a good flow of traffic on an international route involves elaborate negotiation, the number of agreements increasing in proportion to the number of frontiers crossed.

Any airline timetable contains innumerable examples of the effects of traffic agreements. Typical cases are the B.O.A.C. Constellation and Stratocruiser services to New York, which can set down but not pick up passengers at Boston *en route* to New York, and the K.L.M. Constellation services from Amsterdam to Sydney, which have no intermediate traffic rights on the Geneva-Rome, Rome-Beirut, Beirut-Damascus and Karachi-Calcutta sections of the journey.

The differing political structures of North America and Europe give the New World operators a considerable advantage over European competitors. Bilateral agreements between America and various European nations enable P.A.W.A. and T.W.A. to carry traffic to and from America and about 20 terminals in Europe; in some cases the agreements embody Fifth Freedom rights, and to some extent America's "flag carriers" are thus able to compete with European regional services. On the other hand, the European airlines' reciprocal operations are confined mainly to a few points on America's eastern seaboard, and domestic routes in the United States are preserved intact for American operators.

Freedom 6, the term applied to internal operations in a foreign country, is normally referred to as "cabotage" (originally defined as trading along a coastline). The term could be applied to (quoting hypothetical cases) a foreign airline's service between London and Birmingham, and also to a non-British service between this country and a British sovereign possession. In practice, cabotage is the exception rather than the rule and does not greatly hamper the international approach to air transport. An exceptional situation is found in Germany, which lacks sovereignty, and must concede full rights to numerous airlines—both long-haul and local. A contrasting case is that of an undeveloped nation which cannot afford air transport and therefore welcomes the benefits which air cabotage can bring.

Background to Failure.—Although the lack of a satisfactory multilateral code represents a failure at international level to find a common means to the same end, disagreement is confined largely to the central problem of traffic rights, and marked progress has been made in secondary aspects of international co-operation in the development of air transport.

Variation in national approaches to this problem, which have so far prevented agreement, can in turn be attributed to differences in local economic conditions throughout the growth of air traffic over the past 35 years. Last year an authoritative study of European airline operations observed that "international aviation was established in Europe, with a relatively dense network of passenger services, ten years earlier than in the United States, where the economic need for such services was nevertheless much greater. The reason was that the first European commercial operators, by playing on the national instincts of their governments and of domestic public opinion, experienced no trouble in obtaining the subsidies which were then, in those early days of aviation, an absolute necessity . . ."

Another quotation, from *Some International Aspects of Air Transport*, goes further, stating that, in 1939, "no less than 55 airlines were competing for the comparatively small amount of traffic generated in Europe. An average of 60 per cent of those revenues was derived from subsidy and not from traffic."

Parallel progress in America was on a much more orderly and economic basis, because (*a*) a single authority controlled all the subsidies; (*b*) the number of directly competitive airlines was much smaller; and (*c*) the United States was (and is) better ground for any airline operator, by reason of good stage-lengths and suitably dispersed traffic-centres.

Development of the U.S. airline industry was entrusted, in 1938, largely to the newly established Civil Aeronautics Board, charged with considering, *inter alia*, "the promotion of adequate, economical and efficient airlines. . . . Competition to the extent necessary to assure the sound development of an air-transportation system properly adapted to the needs of the foreign and domestic commerce of the United States. . . ." The Act setting up the C.A.B. authorized mail-payment sufficient to enable the development of certificated airlines "under honest, economical and efficient management."

With this background in mind, it is easy to appreciate the clash of ideologies—as concentrated in the British and American approaches—at Chicago in 1944. Britain's recollections of the evils of over-competition at public expense made it impossible for her to accept the principle of full freedom. No complete solution is yet in sight; and nor are the international conditions necessary to implement the proposal for a unified world airline.

International Standards.—A compelling post-war need envisaged at Chicago was the setting-up of machinery for international collaboration in the field of air transport. The result was the formation, in June 1945, of the Provisional International Civil Aviation Organization under the terms of the Convention on International Civil Aviation. Ten months later, P.I.C.A.O. lost its temporary prefix; and in April 1947, I.C.A.O. became a specialized agency of the United Nations. Presided over by an American, Dr. Edward Warner, I.C.A.O. exists to co-ordinate the civil-aviation policies of 58 member-nations.

Undoubtedly the most far-reaching achievement of the organization has been the development of standards and recommended practices "in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation." These rules take the form of "Annexes" to the Convention ratified by member-nations. Adoption of the final Annex took place in 1951. The subjects covered are as follows: Personnel Licensing; Rules of the Air; Meteorological Codes; Aeronautical Charts; Dimensional Units used in Ground-Air Communications; Operation of Aircraft; Scheduled International Air Services; Aircraft Nationality and Registration Marks; Airworthiness of Aircraft; Facilitation of International Air Transport; Aeronautical Telecommunications; Air Traffic Services; Search and Rescue; Aircraft Accident Inquiry; Aerodromes.

Constant amendment of the rules framed under these headings is essential in the light of developments in each sphere. The work of standardizing is by no means complete; for example, no agreement has been reached on the airworthiness of turbine-powered aircraft. Britain has therefore had to compile her own regulations, based on I.C.A.O. philosophy. The vital need for universal agreement on matters of this type is demonstrated by America's refusal to accept the British standards as expressed in the grant of a certificate of airworthiness to the Comet. Another controversial question not yet settled is whether or not the use of kerosine should be mandatory in such aircraft.

One of the most important of recent regulations to be evolved was that specifying the type of approach-lighting to be installed at airports to assist pilots landing in poor visibility. Use of the "cross-bar" system, as exemplified by the British Calvert and the American A.L.P.A. types, has now been recommended. Many authorities have delayed installation of approach lights pending I.C.A.O.'s decision, while, at London Airport, the Calvert lighting has been giving excellent results for several years. A problem as yet unsolved is the standardization of navigational aids, with British and American interests advocating completely different systems. Pending agreement, national authorities have either waited or made their own choice regardless of I.C.A.O. Cases of this sort seem to indicate a need for some streamlining of I.C.A.O. procedure to enable vital matters to be dealt with at a speed which matches the growth of air traffic and of aviation knowledge.

By separating the world into ten navigational regions, I.C.A.O. ensures that action is taken to discover and remedy defects peculiar to each region either in ground or air facilities. Communications, meteorology and traffic control demand especially close study today, in view of increased speeds, operating altitudes and frequency of service.

Countries such as Iceland, which is importantly situated in relation to a major international route, cannot be expected to bear the expense or responsibility of maintaining navigational aids used by several other nations. The I.C.A.O. programme therefore makes provision for joint financing of services in these areas. The weather, radar and radio services in Iceland and Greenland, costing £500,000 annually, are paid for by eleven countries; over a dozen nations contribute directly or indirectly to operating the ten weather ships (a still more costly service) which stand guard in the Atlantic—plotting the weather, exchanging observations with aircraft and providing navigators with radar fixes and beacon transmissions.

I.C.A.O. is also responsible for spending a small percentage of the U.N. appropriation for economic and social aid. Last year the allowance was $857,000, and the estimate for 1953 is $1,500,000. The money is spent in the form of technical assistance to under-developed countries wishing to develop civil aviation but lacking the experience or capital to do so. About 400 students have been trained in 27 countries, and over 100 instructors are giving training "in the field"; several foreign students have also been awarded fellowships to study abroad, notably in the United Kingdom and America. Most of the training so far has been in such occupations as communications, traffic-control, meteorology, airport management, aircraft and engine maintenance and aircraft inspection.

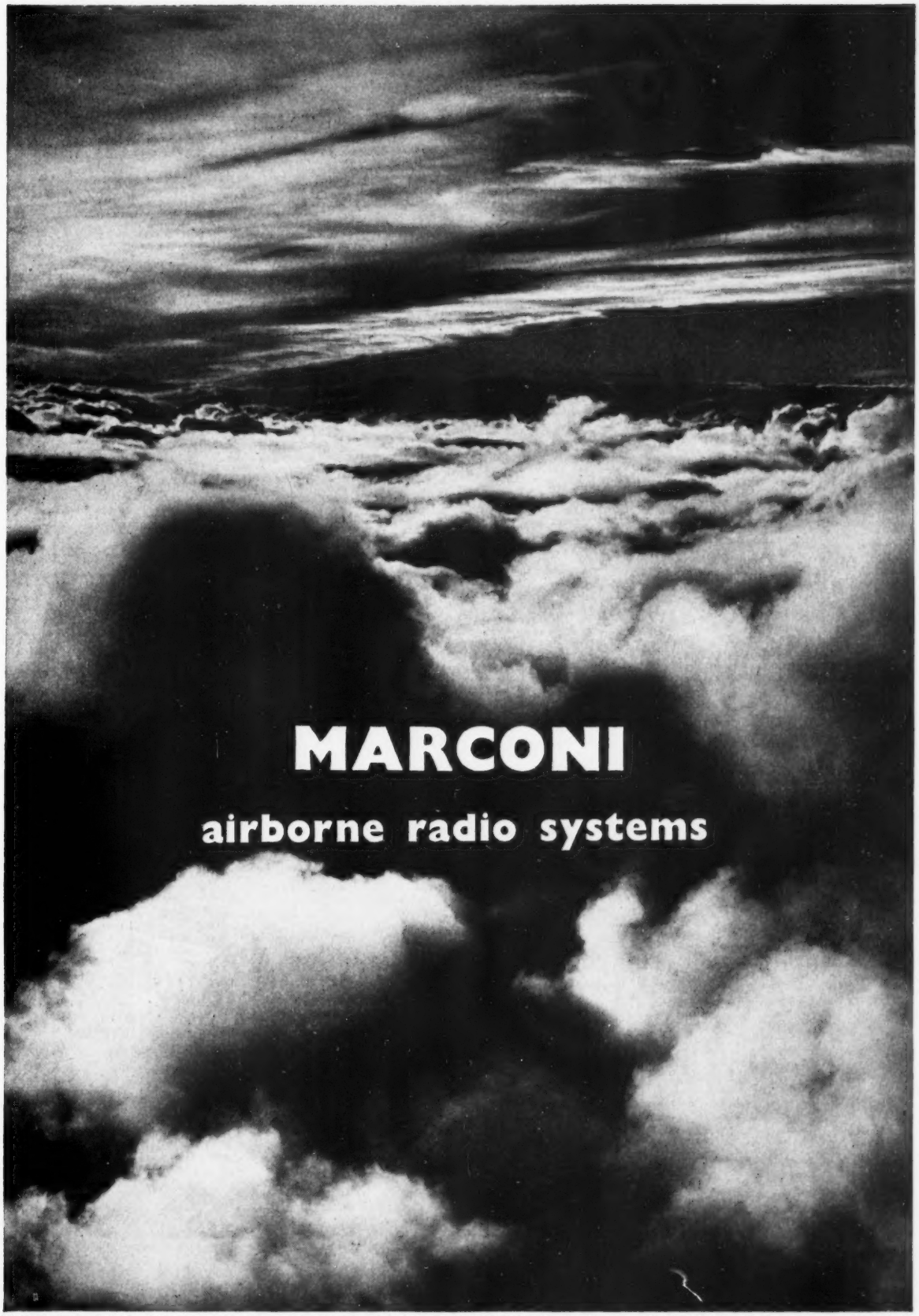
Russia and Communist China have never joined I.C.A.O.; nevertheless, member-nations are estimated to carry 90 per cent of the world's scheduled air traffic. On the basis of ton-miles performed in 1951, the ten foremost countries were: the United States of America, the United Kingdom, Brazil, France, Australia, Netherlands, Canada, Mexico, Colombia and India.

Government Subsidies.—Although financial self-sufficiency is the goal of every major airline, only four of the large American domestic carriers (T.W.A., American, Eastern and United) have become—quite recently—independent of subsidy through air-mail payments. Since most national airlines elsewhere receive direct or hidden subsidies, it is evident that the air-transport industry, as a whole, is still dependent on public support. An indication of the degree to which American airline operations were subsidized in 1951 is contained in Dr. Jerome Hunsaker's book *Aeronautics at the Mid-century*; domestic trunk-lines' earnings for the year included 6 per cent mail revenue, and the corresponding proportion of the overseas operators' revenue was 22 per cent. Total mail payments to both classes of operator amounted to $99 million, against the Post Office's air-mail revenue of $74 million.

American airlines are paid air-mail rates which vary according to the C.A.B.'s evaluation of economic data supplied by the company. The Board makes a retroactive payment calculated to give the carrier an overall profit, having taken into account the actual cost of carrying the mail and the efficiency of the carrier. In the case of the non-subsidized airlines mentioned earlier, the rate paid is thought to be equal to the cost of carriage.

One advantage of the mail-pay system of subsidy is that the cost of developing air transport is at least partly borne, through the Post Office, by members of the public who receive some direct return for their money.

Government provision of airports and other fixed aeronautical services can also represent a form of subsidy, since their cost is normally in excess of revenue from landing fees and similar charges. The imposition of the 5s passenger tax at British airports last year illustrates the principle of recouping part of the cost of airports from those who make use of them. It can be effectively argued that airlines should not be regarded as the only factions to benefit from the existence of ground services, since airports are part of national defence and an asset to the taxpayer, both as a passenger and as a user of the air-mail service. The airlines them-



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TRENDS IN AIR TRANSPORT . . .

selves have potential value as a reserve for wartime transport purposes are further entitled to support as instruments of public service and prestige.

While hidden subsidies can be criticized as being liable to abuse, there are also arguments against straightforward compensation for deficit, as paid to the British Corporations. The latest B.E.A. report, noting that Air France and S.A.S. received large revenue payments for domestic services far in excess of their declared profits, complains that subsequent unfavourable comparisons on a profit-and-loss basis are discouraging to the staff. It must be admitted, in fairness to B.E.A., that it receives low mail-rates, pays excessive fuel tax, operates "social" services as a duty to the public and has no opportunity to work on the long-haul routes which enable other European operators to offset the losses often incurred on regional services.

International Mail-rates.—About three-quarters of international air-mail is carried by aircraft of the country of origin at a rate determined by the government or postal authority concerned. The rates for mail flown by foreign aircraft are fixed by the Universal Postal Union; since 1948 these rates have been six gold francs per metric ton-km (about 10s per ton-mile) for long-haul services and three gold francs for short-haul services. Last year the U.P.U. decided to introduce lower rates of four and three gold francs in these respective categories. This unilateral action was taken without negotiations with the airlines. In the interests of stimulating traffic-growth (which benefits users of air-mail in addition to other services), the airlines contend that a high mail-rate, based on the price which the sender is prepared to pay rather than the actual cost of carriage, is fully justified. The effect on passenger-traffic of an increase in fare is obviously far greater than the effect on mail-traffic of a proportionate increase in mail-rates. These arguments, however, were ignored by the U.P.U.

Combined Operations.—The past few years have shown a pronounced trend towards greater co-operation, and in some cases merging, of airlines as a means of improving efficiency of economy. An outstanding example was the formation of the Scandinavian Airlines System "consortium" in 1951, by which the Danish, Norwegian and Swedish national carriers became a single, sizeable airline which has since greatly strengthened its competitive position. The individual companies retain their identity but, for traffic purposes, can be regarded as a unit. Four mergers of American domestic operators have taken place, the latest—between Delta Air Lines and Chicago and Southern Air Lines—being due to take effect in June. Further American mergers are likely, and the possibility of similar combinations of British independent operators is not to be excluded.

References by B.O.A.C.'s chairman to projected global services by British Commonwealth operators suggest the possibility of closer grouping of the companies likely to be concerned. A degree of Commonwealth co-operation is found in the partnership Springbok and Kangaroo routes operated jointly by B.O.A.C. and, respectively, South African Airways and Qantas.

Pooling of services—and in some cases of spares and overhaul facilities—is already widely practised on the Continent. A number of proposals have been put forward for unifying European air transport, but so far such schemes remain on paper.

Trends towards gradual reduction of the number of large operators have been accompanied by a very marked contraction in the field of private and non-scheduled operators—particularly in America. Employing war-surplus aircraft and keeping their overheads at a minimum, the "nonskeds" played a major role in bringing down the cost of air travel—not only in America but on the North Atlantic route, the Europe and Mediterranean region and—before very long—in practically every region of the world. By undercutting the subsidized scheduled airlines, and thus forcing them to become "coach"-minded, these small but tenacious American operators greatly accelerated the advent of a policy which is now the basis of practically all forward planning in civil aviation.

Airline Parliament.—International agreements on traffic rights, as outlined earlier, are naturally dependent upon accepted standards of rates and fares for each route. Since the airline operators are clearly best qualified to assess the costs of air transport, the formation of the International Air Transport Association, at Havana in 1947, was a logical step in the post-war evolution of an orderly civil-aviation structure. I.A.T.A., which is a more powerful revival of the pre-1939 International Air Travel Association, has its headquarters in Montreal under the same roof as I.C.A.O. Its director-general is Sir William P. Hildred.

The most important of I.A.T.A.'s activities is that of fixing rates on international routes in each of three traffic areas—No. 1, North and South America, Greenland and the Hawaiian Islands; No. 2, Europe, Africa and the Middle East, including Iran; and No. 3, Asia, Australasia and the Islands of the Pacific, with headquarters at New York, Paris and Singapore. Each area is the scene of a traffic conference, held annually, at which delegates of most of the 67 member-airlines determine the exact cost of fares on each route. Their decision must be unanimous; as bitter arguments are sometimes carried down to the last farthing of a fare or even the contents of a passenger's sandwich, the traffic conferences are liable to run for several weeks.

The results of recent conferences, the most significant in I.A.T.A.'s history, were the now well-known decisions to introduce cheaper "tourist" services in the following stages: North Atlantic, May 1st, 1952; Middle East, India, Pakistan and Ceylon and Europe and South Africa, October 1st, 1953; from Europe to the Middle East and from Australasia to North and South America, April 1st, 1954. These new standard fares (in a few weeks there will hardly be any first-class air services in Europe, so the term "tourist" loses its point) are normally made possible by a reduction in baggage allowance and an increase in the number of seats per aircraft. The full effect of the reduced North Atlantic fares will not be apparent until completion of a year's operations by the 11 airlines concerned; provisional 1952 figures show that 400,000 passengers flew the Atlantic last year, about 20 per cent more than in 1951—as against a 6 per cent increase between 1951 and 1950. Although it was hoped to attract a completely new class of passenger by introducing lower fares, while maintaining the same level of first-class bookings, there are signs of a not unnatural shift to standard services on the part of passengers who formerly flew first-class.

Route	No. of Services Weekly	Distance	Single Fare		Cost (pence per mile)	
			Standard	1st Class	Standard	1st Class
Adelaide-Melbourne ...	22	404		£4 10 0		2.7
Adelaide-Sydney ...	16	717		£11 15 0		3.9
New York-Minneapolis	6	1,018	£17 0 0	£22 0 0	4.0	4.7
Salisbury-Bulawayo ...	16	217	£4 10 0	£6 6 0	5.0	7.0
Aberdeen-Wick ...	6	151		£3 5 0		5.2
London-Nairobi ...	8	4,346	£110 0 0 £92 0 0*	£154 0 0	6.2 5.2	8.9
London-Glasgow ...	47	344	£4 0 0†	£8 0 0	2.8†	5.6
London-Sydney (*via* India).	7	10,575		£294 0 0		6.7
London-New York ...	24	3,443	£96 9 0	£141 2 0	6.7	9.9
Zurich-Geneva	10	144		£4 0 0		7.0
San Francisco-Sydney ...	4	7,434		£223 5 0 £213 10 0		7.2 7.1
Rio-Salvador	43	757		£22 10 0		7.1
London-Paris	98	216	£6 10 0	£8 17 0	7.2	9.8
London-Johannesburg ...	6	5,650		£175 0 0		7.4
Nelson-Wellington	8	96		£3 0 0		7.5
Buenos Aires-Santiago ...	11	702		£23 0 0		8.8
Cairo-Khartoum ...	4	1,004		£31 0 0		8.9
Bulawayo-Lusaka ...	3	327		£12 12 0		9.2
Moscow-Helsinki ...	2	550		£40 10 0		18.0

* Colonial Coach. † Hypothetical case; based on £8 weekly return fare (winter only).

There have been a number of threats to the unity of action which I.A.T.A. regards as a fundamental part of its efficiency as a rate-fixing authority. On some occasions governments (who normally accept I.A.T.A.'s proposed rate-structures for the routes covered by bilateral agreements) have permitted local operators to undercut I.A.T.A. airlines exercising the Fifth Freedom; the most significant example of such action occurred in the Argentine last year. Strong protests were registered at the annual meeting of I.A.T.A., where the director-general expressed a hope that "governments will be tolerant and understanding in the use of their undoubted rights . . . and continue as far as they possibly can to leave rate recommendations in the hands of a body of men who have done it well for seven years, who understand its ramifications to the last cent, the last lira, the last krone and the last little sixpence."

A more serious threat to I.A.T.A.'s powers is the possibility of an open breach in fares policy between its members. The purpose of the unanimity ruling is to keep dissension within the bounds of the conference. One of the largest and most influential members—P.A.W.A.—threatened to walk out of I.A.T.A. when, in 1951, its proposals for a $250 Atlantic single fare were rejected. An extra traffic conference was called, and PanAm agreed to the slightly higher rate introduced in May, 1952. At the time of writing this situation is repeating itself in New York, where an I.A.T.A. meeting is attempting to set acceptable cargo rates for the North Atlantic. P.A.W.A.'s proposals for a 45 per cent cut have, according to W. G. Lipscomb, the airline's vice-president (traffic and sales), "been blocked by some airlines which have not had experience with low rates. . . . We are therefore planning to go ahead on our own."

The Price of Air Travel.—A striking illustration of the effects of differing geographical, technical and political circumstances upon the cost—and consequently the price to the travelling public—of air transport is provided by the table above. This shows approximate fares in terms of pence per mile on a number of routes in various parts of the world. It should be emphasized that these figures are intended solely as a guide and no special significance should be placed on the selection of routes. In each case the great-circle distance is assumed, and the current bank exchange rate has been used in converting foreign fares.

The figures certainly show that real progress has been made in some parts of the world, where operating conditions are most favourable, towards reducing airlines fares to the level of, and even below, surface-transport charges. This encouraging trend is certain to be accelerated and become more universal as new and more economic aircraft are introduced. Such a development is essential if air transport is to fulfil the promise given in recent years of a new era in world travel. R.B.

TOMORROW TAKES SHAPE

A Dissertation on Prospective Airliners

GEOMANCY, defined in the dictionary as "divination by means of figures or lines," might be said to be the means employed for the writing of this article. The way of the prophet has always been hard, and the author—a member of our staff—is prepared to have his prophecies challenged.

BEFORE discussing the characteristics of the airliners which are likely to be seen on the world's airways by 1960, it will be advantageous to review the progress made since the last Commercial Aviation Number of this journal was published (May 16th, 1952).

During this period, two major factors have changed the airline scene: the introduction of low-cost fares on a very widespread scale, and the advent of high-altitude turbojet airliners as vehicles for the transport of fare-paying passengers. Both these factors are welcome as evidence of the generally healthy state of air transport.

The impact of the Comet upon airline operators and the general public has been greater than that of any other transport. Reaction has, in the main, been favourable, but many responsible persons have expressed the view that B.O.A.C.'s decision to operate this type of aircraft is somewhat premature. It is exceedingly difficult to determine to what extent this view is an attempt by aircraft manufacturers and operators to stave off the severe competition which the Comet implies. Generally speaking, however, most of the criticisms levelled at the aircraft have been uttered in all good faith.

American airliner manufacturers—the views of four of whom are expressed on pages 277-281—know only too well that to sell turbine-powered transports they must aim at producing a far more advanced aircraft than either the Comet 1 or the Viscount 700. Both these aircraft have by now flown thousands of hours over a period of years, and more advanced types are already being prepared in this country to take their place.

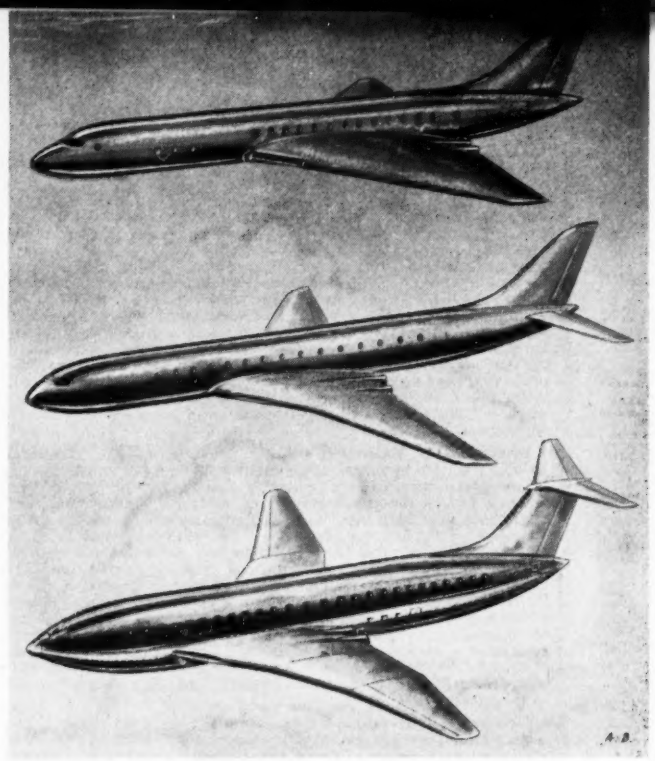
Transport-aircraft production has been something of an American preserve, and we must expect U.S. manufacturers to do their utmost to hold this market until they can offer truly modern aircraft—as opposed to "pulled-and-beefed" versions of war-time designs.

A study of the American transport picture rapidly resolves itself into a study of the American gas-turbine scene. Without wishing to offend their manufacturers, we cannot visualize the J-40, J-71 or J-73 turbojets in airline service. Interest, however, centres about the Pratt and Whitney J-57 and the Curtiss-Wright J-65 Sapphire.

The latter engine is still essentially the English Sapphire and is therefore well known on both sides of the Atlantic. It should make a good transport engine, for it is small, compact and offers above-average economy. The J-57, however, is a different story. Of "two-spool" layout, this mighty Pratt and Whitney achievement has potentialities as great as those of any aircraft engine now flying. Construction is largely of steel, and the compression ratio is extremely high. The former feature should permit a great deal of development to higher powers and temperatures, while the latter implies very low fuel-consumption. Unfortunately, the engine's bulk and steel structure make it very heavy, and fuel economy is not, we believe, significantly better than that of simpler units. The J-57 could not be "buried" in any present wing—with the exception of a large-chord delta—and, in fact, we are unaware of any American gas turbine capable of efficient airliner propulsion at the present time.

American turboprops appear to have caused much trouble, and have, as yet, amassed an insignificant flight-time. On the other hand, there are indications that turbine-propeller units of great promise are being developed in America, and we look forward to the day when they will power transport aircraft. But it is still the next five years which will be decisive in the first round of this battle for markets, and the new American turboprops are unlikely to exert great influence during this period.

Of the types of airframe which the American manufacturers are developing for the new transport era very little is known definitely; but much may be surmised. U.S. operators have expressed their requirements publicly and have stated, *inter alia*, that they are opposed to the development of any transport with fewer than 60 seats. They also want to reduce automatic devices to a minimum; many have expressed disapproval of the universal British practice of burying the engines in the wing—for controversial reasons. In general, American operators have been publicly pessimistc and, perhaps, over-cautious. This is the legacy of the present comfortably profitable American era, which no one wants to see disturbed. But if U.S. airlines are to compete on their international routes, some courageous decisions must be taken.



Although not necessarily accurate in detail these sketches give a good impression, for the first time of (from the top) the Avro delta transport, the Vickers V.C.7 and the Handley Page H.P. 97.

The four American companies whose chiefs' messages appear in this issue are each known to be actively developing jet transport aircraft. From pure conjecture it appears likely that these products will be sleek, rakish designs of up to 160ft span and length, with a structure-weight percentage of over 30. Empty weight is likely to exceed 100,000 lb and wing loading will exceed 75 lb/sq ft. Power is likely to come from four J-57 turbojets in two huge pods which may also house bogie undercarriage units. The new airliners are likely to be under-powered at first, but should offer a fine basis for development. The prestige of its manufacturer will ensure that each makes a great impression when it is publicly launched; but no seat is likely to be sold in an American jet until 1958 at the earliest.

In Europe a wide variety of new transports is under active development in several countries. France will shortly be able to show a turbojet transport developed jointly by the S.O. and S.E. groups, and other work is going ahead on designs by Breguet, Dassault and Hurel Dubois, employing turbojets, turboprops and ducted fans. The latter type of engine has been under continuous study in France since the end of the war. SIAI-Marchetti are developing new transports in Italy; Fokker have completed the detail design on the F.27 Friendship medium-range DC-3 replacement, and Russia is certain to be developing new transports to replace her own rather time-expired equipment. Canadair, Ltd., have prepared a specification for a medium-range airliner (very similar to the Fokker F.27) which is available in several forms under the style Canadair CL-21.

British designers are showing signs of increased activity in the short- and medium-range fields; one example—mentioned by an American source—is the "Handley Page H.P.R.3." On the other hand, there is still no true "Rapide replacement," for which this journal has pressed for so long.

It is also to be expected that the next few years will see even more advanced developments of the Viscount and Britannia brought to the prototype stage. These aircraft will have great carrying capacity and high speed, and may be able to offer world-beating economy. At the present time there is no evidence of any impending shortage of good transport power-plants, and it appears likely that British airliner designers will not have to work their aircraft around an unsuitable engine.

Particularly in the field of "mainliners," the future appears very bright for this country. In spite of the very high cost of developing such aircraft, four British firms have on their drawing-

boards airliners which will set the standard of world air transportation for many years to come—for present evidence indicates that each design will not only be built but will be built in numbers.

The first of these types is the de Havilland Comet 4. We give it this title for want of a better, although it is reported that de Havilland's successor to the Comet 3 will be so different as to merit a new name. Powered by four Rolls-Royce Conway by-pass engines, it is likely generally to resemble the Comet but will differ, in having a wing of lower thickness/chord ratio and perhaps a little more sweep; the all-up weight may be in the neighbourhood of 200,000 lb.

Sketches of the other three designs appear on the opposite page. It should be emphasized that these drawings are purely conjectural, but they are believed to be indicative of current thinking. At the top is an impression of a possible civil development of the Avro Vulcan delta-wing bomber. Sir Roy Dobson has declared that this aircraft, carrying 150 passengers (and he did not mean troops) would be able to cross the Atlantic between England and New York three times in a 24-hr period, allowing two to three hours between flights. This would imply a still-air range of at least 5,100 miles when the usual allowances are taken into account. It may be assumed that fuselage length will be considerably over 100ft—i.e., greater than the Vulcan wing-span. Power plants may remain as four Bristol Olympus two-spool turbojets. If the all-up weight works out at 180,000 lb, the wing loading will be no more than 60 lb/sq ft; whether a tail parachute will be employed, as in the bomber, is uncertain. It is used on the bomber to reduce tyre and brake wear, but it is not regarded as essential.

The aircraft represented by the centre sketch is the Vickers V.C.7. It may be recalled that the Secretary of State for Air, speaking of the military Vickers-Armstrongs Type 1000, said recently that it would be capable of ferrying 150 troops 2,000 miles in 4 hr, cruising at between 45 and 50,000ft. There is no reason why the civil V.C.7 should have an inferior performance, and its impressive 146ft fuselage, coupled with the economy of four Conway by-pass engines, promises to make it a most attractive proposition for long-distance operators. It is likely to be a single-deck aircraft, of conventional layout and extremely graceful appearance.

Double-decker

The massive double-decker shown in the bottom drawing is Handley Page's H.P.97, whose existence was revealed at the last S.B.A.C. Show. According to the manufacturers, it will have a capacity-payload of 50,000 lb, seating "96 in luxury or 150 tourist." On the lower deck will be entrance foyers, lounges, a small cabin and a bar, together with two freight holds of 400 and 600 cu ft. The upper deck will, it appears, be provided with no fewer than 25 square windows each side for the benefit of the passengers. Flying a non-stop route between London and New York, the aircraft has been pronounced capable of a west-bound trip in 7½ hr with 117 passengers, and an eastward trip, with 122 passengers, taking 1 hr less. Between Cairo and Karachi (2,210 statute miles) 148 passengers and 8,500 lb of freight could be taken, the journey time being 4½ hr and the specific cost 0.7d per passenger-mile.

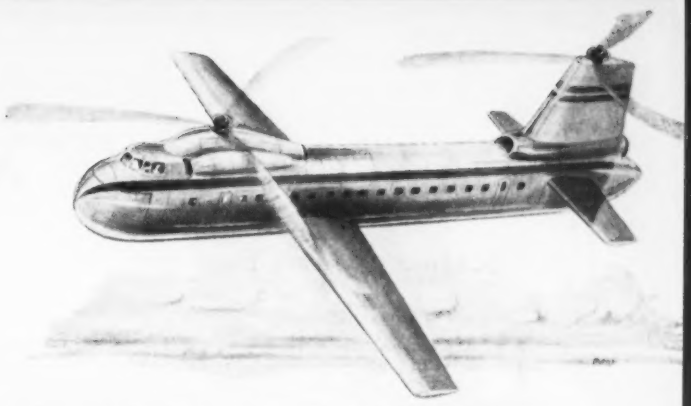
All these airliners are likely to embody advanced features such as non-skid brakes and, perhaps, reverse-thrust power units, and all could be in scheduled service before 1960. Moreover, they will benefit from being developments of established types already flying.

Considerable attention should be paid to the rotary-wing family. Just how much helicopters can offer has, until fairly recently, been known only to a few. Even with the present elementary and uneconomic aircraft almost every country has some sort of helicopter service, and when any great national disaster occurs—the recent flooding, for example—rotary-wing aircraft, alone capable of certain kinds of rescue and supply operations, are seen in a most valuable and unique rôle.

Illustrated on this page is a somewhat futuristic aircraft which may appear to be a strange cross between the Bristol 173 and the familiar Freighter by the same concern. The sketch is intended to show the sort of thing which we may expect to see from a company such as Bristols by 1960, if development continues along the present lines.

The drawing postulates the provision of two Proteus turboprops, one powering each rotor with suitable inter-linking transmission to cater for the event of engine failure. Assuming an all-up weight of 48,000 lb and a rotor diameter of 90ft, the disc loading works out to 3.75 lb/sq ft in the hovering case. The aircraft is shown to adopt the vital feature of fixed lifting surfaces which, by unloading the rotors at cruising speed, permit smaller blade incidence and, consequently, much enhanced cruising speed. At present this is the only published method of increasing the economic cruising speed of a helicopter beyond about 120 m.p.h.

In this project the cruising speed should be about 200 m.p.h., which has been considered high enough to warrant a retractable undercarriage. The fuselage should be capable of carrying over 70 passengers, and for freight work large nose-loading doors are shown. All rotary-wing aircraft cruise at low altitude, so the cabin is unpressurized and has large square windows.



This conception is intended to show the manner in which British helicopter thought is progressing. In this case, Bristol might be the company.

Faireys, on the other hand, are devoting a great deal of effort to the development of tip-drive rotors, and their Rotodyne principle consists of a tip-drive rotor for lift, assisted by a fixed wing upon which are mounted turbine-driven airscrews for forward propulsion. This arrangement may perhaps offer a cruising speed even higher than that just mentioned and, assuming successful solution of the many design problems posed, the layout has very much to commend it.

The Westland company have for a considerable time borne in mind the possibilities offered by really large helicopters. Of their published studies, that for the largest aircraft features a single main rotor of 196ft diameter, driven by a Sapphire turbojet at the tip of each of the three blades. With an all-up weight of 206,000 lb, the aircraft would, in a military rôle, be capable of transporting 450 troops—a figure to which no fixed-wing aircraft has yet aspired. Despite the obvious problems involved in its building, the whole design appears so essentially logical and straightforward that there is every reason to believe that something like it will really take the air in the foreseeable future.

The other British helicopter manufacturers are Saunders-Roe and Percival, but of the long-term projects of these companies we can say nothing at the present time, beyond the fact that both are actively developing small helicopters, the latter company specifying tip-drive.

Finally, a review of this nature would be incomplete without reference to flying-boats. Marine aircraft can now offer efficiency at least equal to that of corresponding landplanes, particularly as the all-up weight increases. British flying-boat studies are known to include the six-jet swept-wing Duchess of Saunders-Roe which, even with elementary turbojets, has been proclaimed the most economical transport design of its time (1951). Of even more advanced conception are the studies described by Mr. H. Knowler in his Bleriot Lecture to the British Association last year. This journal published an illustration of one of these showing a "triple-bubble" pressurized hull of fine aerodynamic form; the wing appeared to be of aero-isoclinic design, and a power installation of six turbojets was mounted at the roots of the tailplane. Mr. Knowler dealt at length with the optimum sizes and characteristics of flying-boats required for given stage-lengths, assuming power by each of five basic families of gas turbine. On the U.K. to New York route, with 85 per cent winter frequency, a 300,000-lb aircraft powered with by-pass engines would be able to carry some 150 passengers, taking 8 hr westbound and 7 hr on the return flight. Under these conditions the direct operating cost worked out at about 1.07d per passenger mile. Certainly Britain will be foolish if she neglects entirely the marine airliner.

W. T. G.

BRISTOL FREIGHTERS FOR T.C.A.

TRANS-CANADA AIRLINES believe that they will be the first scheduled operators to put into service aircraft specifically designed for cargo carriage. Delivery of three Bristol 170 Freighters (two Hercules 734s) is planned for September/October, and they are to be introduced without delay on the Montreal-Winnipeg-Toronto route. In addition, they may on occasions supplement other services. T.C.A.'s director of cargo sales, Mr. Hugh Johnson, believes that last year's record total of £14,206,000 of domestic cargo carried by his company will be exceeded in 1953.

The 170, with its payload of almost six tons, is well known in Canada, examples being operated by the R.C.A.F. and by Associated Airways. Over one hundred 170s are in use throughout the world. The T.C.A. order was placed by Mr. Gordon McGregor, president, with the Bristol Aeroplane Co. of Canada, Ltd.

AMERICAN APPRECIATION

U.S. Airline Trends Examined - - - - - - - - by OUR AMERICAN CORRESPONDENT

PERHAPS the most significant trend in the air transport field in America during 1952 was the growth of "coach," or tourist-class, air traffic. Although nearly every big domestic operator was running such services in 1951 (generally during the off-period night hours, when his equipment would otherwise have been idle), it was not until last year that the full potentialities of this type of operation were realized.

By the end of last summer the airlines were saying that this was really the only way to make money, and that it would not be long before the full-fare services degenerated into *de luxe* affairs, fit only for Hollywood moguls and those with unlimited expense accounts. To take advantage of this probable state of affairs all the big carriers began to convert their first-line aircraft to tourist interiors, and to put on services at times of day which were rather more convenient. With such aircraft, and under such conditions, there is very little difference between a first-class and a tourist-class trip, anyhow as far as elapsed time and method of operation are concerned. The only thing a passenger has to put up with is a crowded interior, no free meals (although coffee and biscuits are available) and times of departure or arrival which may not always suit his convenience. The normal cost of a trip, say between New York and Los Angeles, is $158, while the tourist fare is only $99, and with such a considerable saving it is reasonable to suppose that the higher-fare services will not be able to compete for long with the much cheaper, but nearly as comfortable, and certainly as efficient, coach operation.

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WHEN talking about the coach-fare services, however, it is worth remembering that it was not the major scheduled airlines who brought this type of transportation before the American public, but the irregular, non-scheduled companies who started up in 1946 and 1947. Operated mostly by ex-Servicemen, short on finance but long on optimism, they began to run their converted war-time aircraft as and when and where they could, carrying passengers for the lowest possible fares, and by so doing proving that there was a market to be tapped and a job to be done in this field. As time went by, economic forces, lack of capital, inefficiency and pressure from the regular airlines gradually forced these pioneers out of business. Their accident-rate was too high and their profits—if any—too low; and by 1950 only a very few of the more responsible big "irregulars" remained. But the demand did, and the licensed domestic operators, benefiting from this initiative, carried on with C.A.B.-licensed coach services—and found them good, so good that they now form the most important type of operation on the companies' immediate horizon.

To show what interest there is among the large carriers, it may be added that T.W.A. are converting all their Constellations to coach seating, American Airlines turning 12 DC-6s into 80-seaters, and United converting their DC-6s to 72 seats. One operator, T.W.A., claims a record for its 1952 domestic and international coach services of 715 million passenger-miles. Overall coach traffic was up some 83 per cent over 1951.

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IN the cargo field the 1952 figures have not yet been published, but it is certain they will show an increase over 1951. American Airlines, for instance, report a 26 per cent increase in their ton-miles flown—from 37,194,000 in 1951 to 46,898,000 in 1952, and the Flying Tiger Line's domestic freight ton-miles flown increased by 48 per cent. Although the total increase may not be as great (an unofficial source has estimated it as about 14 per cent), the efficiency of the cargo operator is steadily increasing and the education of the manufacturer and consumer continues. The Civil Aeronautics Administration have produced a cargo survey which, using all sources of information, suggests that there will be some 400 million ton-miles of domestic cargo by 1955 and 600 to 800 million by 1960. To move this they estimate that 160 cargo aircraft will be needed—there are approximately 100 to 110 in use today—and they lay stress on the importance of an aircraft specifically designed for such work. The growth of cargo business since the war, in million ton-miles, is as follows :—

1945	22	1949	174½
1946	82½	1950	229
1947	128	1951	246
1948	150¾		

Despite these ever-increasing figures, however, the air-freight industry as a whole reports that it is not yet making money; the domestic passenger lines still rely for their bread and butter on passengers and air-mail subsidies, and the big irregulars—such as Flying Tigers and Slick—on Government cargo contracts or additional maintenance and servicing work at their main bases. In this connection Flying Tiger Line say that only 21 per cent of their 1951 revenues came from domestic freight, while 43 per cent was derived from Government overseas air-lifts (mostly to the Far East) and 36 per cent from charter, renting, servicing, etc.

It would seem that the lack of sufficient and suitable cargo aircraft, which must permit rates of about 10 cents per ton-mile, is the main block to increased turnover and profit. The DC-6B and the freight version of the Lockheed 1049 will go some way towards meeting requirements, but even as pure freighters these aircraft probably demand a cargo rate of about 15 cents a ton-mile, while the rates on cargo-cum-passenger machines, such as those operated by T.W.A., American, United and Eastern, must be nearer 20 cents. In the transatlantic field, Seaboard and Western Airlines and Transocean Airlines are the largest operators and (much to the annoyance of the two regular Atlantic carriers, T.W.A. and Pan American) have carried on a fairly successful cargo service between Europe and the States. The whole question as to their future is even now before the Civil Aeronautics Board, who have been criticized for taking so long to get down to brass tacks on this ticklish subject.

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THE trend of passenger traffic in the States has, of course, been upward ever since the war. The following table gives the figures for 1945 to 1951 (the final 1952 figures are not published at the time of writing and the total given below is provisional) :—

PASSENGERS CARRIED (× 1,000)

1945	7,051	1949	...	...	16,600
1946	13,245	1950	...	...	19,022
1947	14,249	1951	...	...	24,668
1948	14,550	1952	...	...	25,500

1952 passenger-miles flown: 13,150,000,000

As has been pointed out, it is certain that there will be more and more coach-class travel, particularly if there is any sort of a business recession or if there is a reduction in Government military orders. Such a trend will increase the number of passengers carried and probably improve load factors. During 1952 there were some 1,016 transport aircraft in operation throughout the United States, and a considerable number of them were new. There were, for example, several improved versions of the DC-6, besides (though no more are being built) the new Martin 404s now operated by Eastern Airlines and T.W.A.

But perhaps the most noticeable thing about the economics for this past year has been the steady decline in airline profits, despite an increase in revenue. At the end of December the Air Transport Association Economic Research Bureau estimated that although the 1952 revenues would be up something like 14 per cent the profits would be 10 per cent lower than 1951. This is largely due to the considerable increase in expenses—not only because of the purchase of new and larger equipment, but because of the steadily rising cost of everything connected with airline operation. It is also safe to say that load factors suffered—and will continue to suffer—as a result of the increase in size and capacity of the first-class-fare aircraft introduced during the past twelve months.

So far as the domestic accident-rate was concerned, this was remarkably good; that of the American international services, on the other hand, was not. From January 1st, 1952, to December 31st, 1952, fatalities were 0.4 passenger fatalities per 100 million passenger miles on domestic services, but 3.1 on international routes. From February 12th, 1952, to February 11th, 1953, however, there were no domestic fatalities whatsoever, a truly remarkable record and one of which everyone should be very proud. The total of passengers carried during this latter period amounted to 25¼ million.

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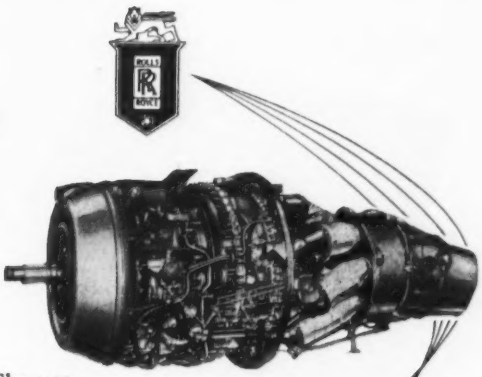
AS a wind-up to any discussion on transport developments here it is sad to have to report that American disparagement of British turbine progress has broken out again. This is probably the natural result of the operating successes and international sales of Comets and Viscounts. It may also be the result of a definite campaign to embarrass the current discussions on mutual recognition of Certificates of Airworthiness for turbine aircraft. But it is a rather sorry spectacle, and appears to have spread to circles

36/HT/38

One good trademark leads to another



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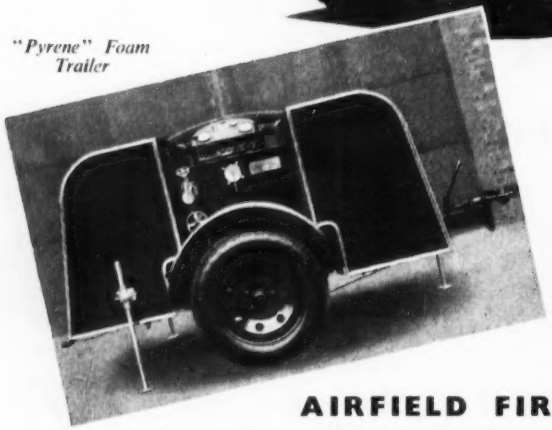

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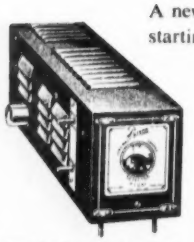

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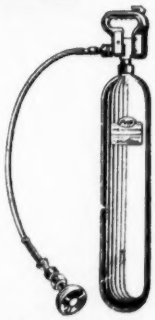

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AMERICAN APPRECIATION . . .

which should know better, and which, if they thought about it for a minute, would realize that they are doing themselves more harm than the other fellow. It is also one more pinprick in an always superficially sensitive area of Anglo-American relationship.

If this sounds unduly touchy to American ears, it should be remembered that the British have put up with a good deal of this technical sniping—most of it unjustified. On the other hand, they themselves are not entirely free from blame. They are inclined to flaunt success in the other fellow's face (an understandably human reaction, and one not confined to any industry, or country, or political party, but extremely irritating all the same), to be a bit over-optimistic and to forget their own intensely nationalistic outbursts when B.O.A.C. so wisely purchased Constellations in 1946.

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YET sour-grape arguments, such as were voiced at a recent meeting of the Institute of the Aeronautical Sciences in Washington, do get under the skin. Luckily, at the meeting in question there was a Britisher present who was in an excellent position to answer the critics. He was Mr. R. E. Hardingham, secretary and chief executive of the Air Registration Board, and he put the record straight in a few soft-spoken but telling words. Somebody trotted out the old story of the Comet being an uneconomic aeroplane, and said that it could neither have been built, nor operated, without Government subsidy. The bogey of "what happens if a window blows out at 35,000ft" was also raised again. Furthermore, our gas turbines were said to be unreliable and, moreover, that they were too noisy and the fire risk was too great. To most of this Mr. Hardingham replied with commendable restraint, pointing out that the engines were proving more reliable than some piston engines at present in use in B.O.A.C., that events had answered the fire-risk criticism and that, as the aircraft was designed so that the wings would stay on, so were the windows designed not to blow out. He finished up with the mild—but very telling—rebuke: "It appears to me you've spent too much time on committees."

He might have added a word on subsidies and pointed out that there was almost as much indirect subsidy to the various branches of the aircraft industry in America as there is in England—through Government research, orders, or mail pay—and that numerous bills have been, and are, before Congress to provide further subsidies for the construction or development of jet transports. If he felt like saying these and other things he was too polite; which was probably a good thing. But it was a mildly rude evening all the same, and a number of people had fun twisting the lion's tail—not so much to hurt the animal, perhaps, as to boost a lagging morale. What made it hard to take was the fact that the Americans are both great enough and generous enough to swallow the pill of British progress without making quite such a fuss and a face about it.

FAR-EASTERN OUTLOOK

Growing Momentum of Air Transport for S.E. Asia's Millions

THIS well-informed appreciation is the work of one whose mission it has been, for many months past, to expand the Far-Eastern interests of a well-known British firm of aircraft constructors, both as regards transports already operating in that area and new equipment that may be supplied. He shows how political and other factors have combined to produce a situation unlike that ruling in any other part of the globe.

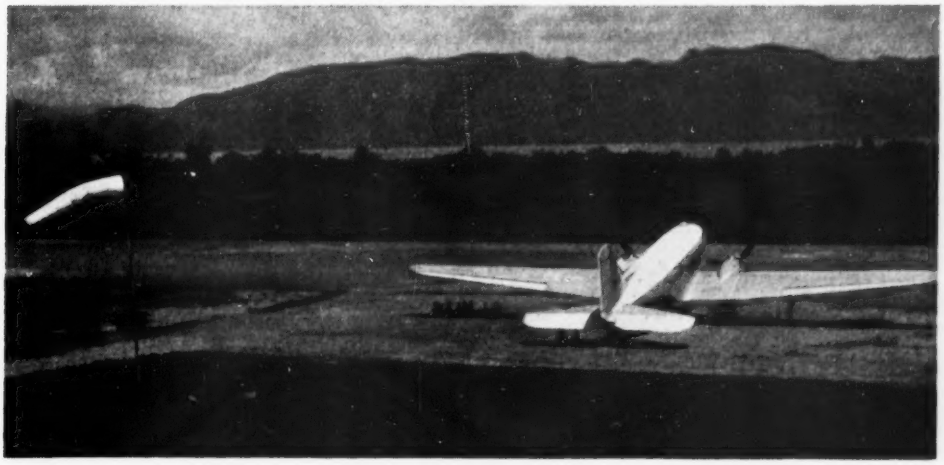
TO generalize about commercial aviation in the Far East would be imprudent, if not impossible. If air transport in the whole vast area were to be judged by the operations of Air India International, which probably carries more traffic between England and India than any other operator, or by Philippine Airlines, which operates the fastest link between London and the Pacific Ocean, one might say that the general pattern of air transport appeared to differ little from that of Europe or America. But air transport in Asia is not in the main a matter of free brandies and press-button service; often it is a seat on a pile of tractor tyres or one's own bed-roll. Between the two extremes lie the hundreds of plane-Jane Dakotas, which come nearer to providing a really public utility than anything that Europe's excessively competitive situation has permitted to develop, with the notable exception of B.E.A.'s service to the communities of the Western Isles.

This note can do no more than point briefly to a few aspects of eastern operations which are not well known in Europe. It is, for instance, a matter of surprise to some travellers to find that Indian aircraft have Indian crews; that Siamese aircraft have Siamese crews. It would be an injustice to under-rate the devoted work in some of the eastern airlines by British and foreign employees; but it would be a bigger injustice to deny that some of the Asian operators have already passed out of their period of tutelage and that most are within sight of self-sufficiency. This is almost entirely true of management and to a considerable extent of aircrew, except in Indonesia and in the still embryonic Japanese airlines. It is in the maintenance hangar that European help or supervision is in most cases still necessary.

There is a sound tendency for operators to strive for technical independence in every detail. A small airline will undertake the high capital expense of equipping itself for full engine and airscrew overhaul, partly in order to avoid dependence on an overhaul organization outside the national frontiers, partly as a deliberate policy to take every opportunity to strengthen the country's engineering resources and training capacity. This is not good economics; but it is good sense and, as such, usually earns government financial help.

The natural development of air transport has been much stimulated in those countries where internal security has not yet been attained—notably in Burma, where Union of Burma Airways are

(Left) A Garuda Indonesian Airways DC-3 at Laha, which is on the island of Ambon. (Right) A trim stewardess of G.I.A.



FAR-EASTERN OUTLOOK . . .

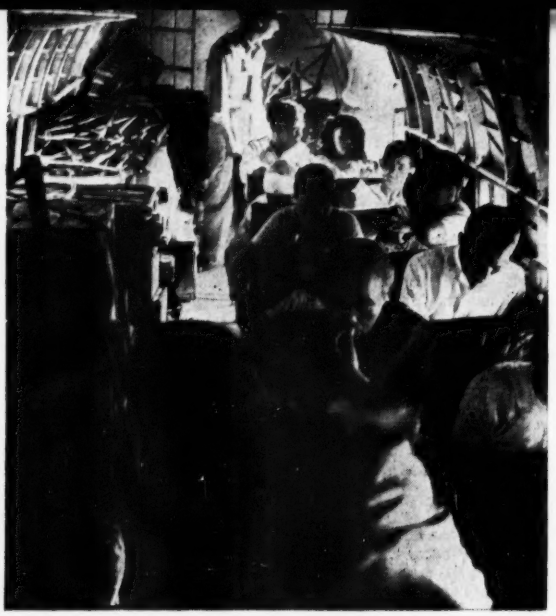
operating their Dakotas, Marathons and Doves under emergency conditions, providing the backbone of the country's internal communication. Their high utilization, assured payloads and virtual transport monopoly are giving U.B.A. both profits and experience. But the pressure on their resources has severely restricted their ability to develop overseas routes complementary to those of their neighbours, the Indians and the Siamese.

It would appear at first consideration that the countries of South-East Asia could profitably form a consortium in the S.A.S. manner; in particular, Burma, Thailand and Indonesia might together be able to sustain an airline able to offer real competition to the major trunk-route operators. But this does not seem welcome to any of the governments concerned. Each country has a different approach to the functions and management of a national airline and each of them is probably committed up to the limit of available finance in maintaining such services as exist already.

Indonesia has a big commitment within her own frontiers. Her hundreds of islands extend over an area the size of Europe and the improvement of inter-island communication must dominate Indonesian air transport policy for some years. It is for this task that a fleet of 14 Herons are to be delivered during 1953. They will operate an ambitious network between one-time Japanese fighter strips; it will bring the principal islands within a few hours of the capital, supplementing steamer journeys of many days and greatly helping the Indonesian Government to exercise firmer political control over their somewhat unruly territories.

Garuda Indonesian Airways is conducted in partnership with K.L.M., who provide all the technical services. The Indonesians have the assistance of one of the many I.C.A.O. missions which are giving invaluable aid in countries where civil air administration is still embryonic; they give all such help in an admirably objective manner and the governments they advise invariably receive disinterested service. I.C.A.O. has assisted Indonesia to organize a civil flying training school. Numbers of graduates are already receiving advanced instruction provided by Air Service Training, Ltd., and it seems likely that Indonesian nationals will make surprisingly fast progress towards independence of foreign aid in civil aviation.

Thailand operates her network, modest but suited to the national needs, under Thai management, with such foreign aircrew and technicians as are necessary employed on individual contracts. The Thai Airlines' DC-4s operate as far afield as Tokyo and must, therefore, compete with external services of the trunk-line operators. This is the basic problem of the regional operator. It is exemplified well in Cathay Pacific Airways, an independent British airline operating from Hong Kong with Dakotas and one veteran DC-4 on services to Singapore, Borneo, Siam and Calcutta, and by Malayan Airways, who operate regionally from Singapore with much technical and financial success. Cathay Pacific conveniently define the rightful field of activity for a regional operator as embracing any service which enables an aircraft to return to base within 24 hours of departure. This is all very well in terms of Skymasters, but Comet performance could transform the conception of regional operation. Further, whereas a thoroughly well-run airline such as Cathay Pacific can offer in a Skymaster a service which is entirely competitive with those of the trunk operators (and with the lower fares which their smaller overhead commitment makes possible), the competition of the Comet may oblige some regional airlines to slip into the rôle of "coach" operators—unless they are able to bear the capital burden of equipping themselves always as well as the world's leading airlines.



Luxury chairs, carpets and colour-schemes are not for the passengers of this Union of Burma Airways' DC-3; but probably they are uncritical, and certainly they take air travel for granted. Note the stacked seating, moved to make room for the freight on the left.

The sub-continent of India is a field for regional operations in itself. The Indian Parliament is about to debate the Bill for the nationalization of air transport which has been in the wind for many months. It is reasonable to expect that two corporations, modelled fairly closely to the British pattern, will emerge. One, for external operations, will be built upon Air India International and probably in the initial stages there will be little change in the operations and management of that concern. The second corporation will amalgamate the present half-dozen scheduled operators of internal services, who, between them, have 50 or more DC-3s in daily service. There are good and experienced men at the head of most of the private companies involved and it should be possible, if personal rivalries can be smoothed over, to create a strong, experienced and entirely Indian management.

While there are plans to keep the Indian DC-3s in service until 1960, it may be expected that a fleet-replacement plan will be formulated within a few months of the corporation's formation and that sufficient Government money will be forthcoming for a number of Viscounts or Convairs to take over the routes between the major cities of India.

In the Far East, as in other fields of airline operation, there are almost as many specifications for the ideal DC-3 replacement as there are operations managers and chief pilots. The DC-3, it must be admitted, is a classic aeroplane and is in many ways irreplaceable, because it has done as well on routes which ideally demand an aeroplane as big as the Viscount as on those which call for a Dragon. The DC-3 formula has acquired a legendary quality which is not entirely realistic. If we assume that many of them will be replaced by Viscounts and Convairs, and many more by feeder liners of the Heron and Marathon class, there still remains a demand for a half-way aeroplane.

There are certain requirements which almost all the operators in the Far East are likely to share. For most, 30 passenger seats represent the optimum size. They should be contained in a cabin of the highest possible volumetric capacity. Airfield limitations demand the ability to use any strip that a DC-3 can use today, while meeting I.C.A.O. take-off and landing requirements. Bearing surfaces often dictate a maximum weight of around 30,000 lb. Robustness and reliability are more important than refined performance, and for most services it is only necessary to be faster than a mule or a ten-knot steamer. Views on the number of engines are probably much less unanimous, but while the DC-3 attitude of mind lingers and, for that matter, while aeroplanes such as the Ambassador demonstrate first-class single-engine performance, the majority vote would probably favour the simplicity of the twin-engine formula. One can envisage, therefore, an unpressurized aeroplane of 30,000 lb a.u.w. (built, perhaps, around two Bristol Hercules), having a 30-seat fuselage of high volumetric capacity, a well-flapped, high-lift wing, a retractable undercarriage and no sacrifice of robustness to unnecessary aerodynamic finesse.

The Far East has already proved a worthwhile market for established civil aircraft from both Britain and America, and the future must be bright. There can be no doubt that, as the economic and technical development of Asia's millions gathers momentum, aviation will carry the main burden of communications in the huge undeveloped continent.

Terminal building at Maoemere, on the island of Flores, one of the places served by Garuda Indonesian Airways. Coconut-milk, we are told, is the only refreshment available for passengers.

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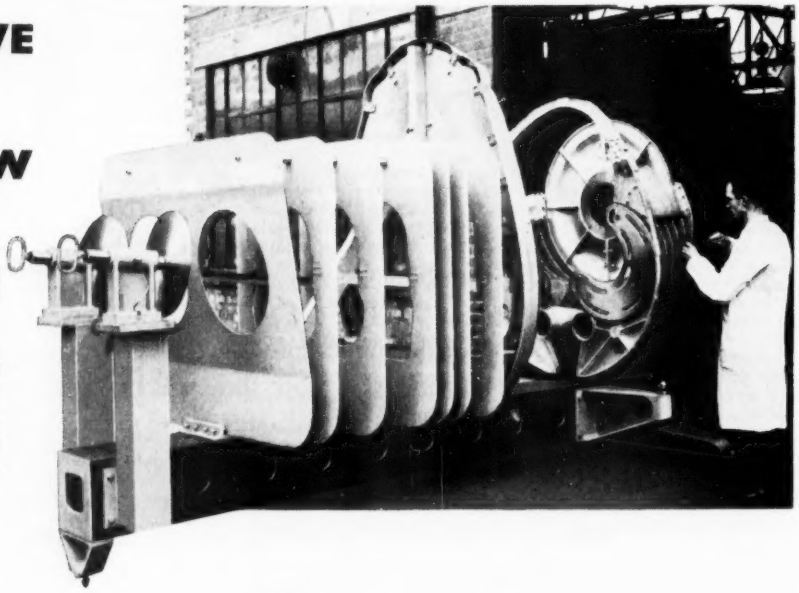

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AIRLINE AVIONICS

A Condensed History of the Various Electronic Aids Available to Airline Pilots

IN these pages it is our purpose to provide a brief exposition of the manner in which the several families of modern radio and radar aids have developed. Today such devices are so diverse that each can be no more than touched upon, but it is felt that many readers will find value in an account which outlines the meaning and uses of such familiar, but to some people puzzling, systems as I.L.S., V.O.R. and D.M.E.

The story really begins in the early 1930s. By 1931 several scheduled air routes were served throughout the year with over 90 per cent regularity. Instrument flying was well established, and radio—carried by British transports since 1919—was becoming popular as an aid to navigation by the use of a direction finding loop aerial. Directional radio beams were also coming into use to provide some measure of assistance in bad-weather landings.

By 1934 several blind-landing aids had been produced. The most widely accepted was the Lorenz system, which used a radio beam projected in the landing direction, so modulated as to consist of a stream of Morse dots on one side and dashes on the other; in the overlapping central zone—down which the aircraft flew to land—the pilot received a continuous note. This system also introduced marker beacons sited at selected points on the landing path to provide the pilot with knowledge of his longitudinal position.

In the United States bonfires were widely used to delineate the trans-continental night mail routes, but in the early 1930s a movement began which was to have a profound significance on civil air routes throughout the world. By about 1934 the American Civil Aeronautics Administration was firmly convinced that a national system of "airways" was the desired aim, each route being marked by a series of directional radio beacons. From that time onwards the construction of such airways has proceeded until every major American city is today on one or more radio "ranges" having characteristics described below.

The first radio range stations housed a beacon which projected a split beam, one side of which was a continuous repetition of the Morse letter A and the other side a similar transmission of the letter N. As with the Lorenz landing system, the pilot heard a continuous note when flying on a straight course along the centre of the beam. Where two airways crossed, a four-course range station was established emitting the A/N beam along the four airway routes leading from the station.

It will be appreciated that, particularly at four-course stations, orientation could cause difficulties. The low frequency of the range (200-400 kc/s) made the emission liable to static interference, and numerous inaccuracies, such as bent beams, night effect and multiple course radiation, prohibited the placing of absolute confidence in the system.

Visual-aural Range

Many of these difficulties were overcome by the Visual Aural Range, or V.A.R., which came into general use in America in the 1940s. Each V.A.R. station houses a transmitter emitting an A/N beam across the major route and a continuous note along it; the continuous-note beam is so modulated as to have a frequency of 90 cyc/sec on one side and 150 on the other. V.H.F. transmission was used which, although it removed the static interference problem, also suffered from line-of-sight range limitations, so requiring a separate station every 100 miles, assuming a station power of 200 W. The airline pilot usually flies a V.A.R. range by referring to the visual beams (which govern the movement of an instrument needle), the aural quadrants being used for orientation.

Since the radio range provided the pilot with no more than an indication of track, some means was required to provide position fixing at important staging points on the route. The characteristics of the beam emitted by each station caused a "cone of silence" at each station, so providing a rough indication of position, but the cessation of reception could not be taken as an indication of actually passing over the station, due partly to the size of the "cone" and partly to the occurrence of false cones of silence due to natural causes.

Accurate position fixing was made possible by the siting of marker beacons, arranged like mileposts, sending a vertical cone of radio waves up into the airway beam. Station Markers (known as Z markers in the U.S.A.) emit a 3,000 cyc/sec cone on a frequency of 75 mc/s with a continuous power of 5 W; there is no indentification keying. The marker has a diameter of rather over 3,000ft at 1,000ft altitude, which diameter is roughly maintained above that height. This represents about 9 sec flight at 200 kt. The pilot is made aware of passage over the beacon by the illumination of an instrument panel light and by reception of the 3,000-cyc/sec cone in his head-set.

Fan markers (known ambiguously as FM-markers, so provoking confusion with frequency modulation) are located at strategic points on airways or at specified distances from range stations. Emitting a beam of the characteristics just described, their power is usually no less than 100 W. The beam is shaped like a fan, broadside-on to the flight path of the aircraft; at 3,000ft the fan is roughly 12 miles wide and about two miles deep, the latter distance being kept short to provide more precise position-fixing. Low-power fan markers (LFM) of 5 W only are sited, like Z markers, near a range station, the latest types having a dumb-bell-shape cross-section to enable the pilot to cross the marker quickly.

V.H.F. Omni-range

Even the latest 4-course ranges suffered from the obvious limitation that they were useless unless the recipient happened to be on one of the courses served. The obvious development was an omni-range station emitting radial beams throughout 360 deg in azimuth, like a wheel with an infinite number of spokes. Largely developed in America, omni-range stations (V.O.R.) are today spreading over much of the Western world. V.H.F. transmission is used, a typical station having a power of 200 W in the 112/118 mc band. The V.O.R. aerials put out two signals sweeping through full 360 deg arcs in the horizontal plane, their relative phase varying with azimuth. Since V.H.F. is used, transmission range is limited and American experience indicates a station every 100 miles. The two signals (one of which may be a pulse emission and the other a continuous sinusoidal wave) are received over the normal airborne V.H.F. set, phase comparison being used to determine the bearing of the aircraft from the V.O.R. station or *vice versa*. Identification keying (a three-letter code) is provided to avoid confusing two adjacent stations, and voice communication by normal V.H.F. is possible.

Protagonists of V.O.R. point out the simplicity of the airborne equipment required and the general flexibility of the system. On the other hand, it cannot be denied that nation-wide coverage demands an enormous capital outlay—although many European nations are being subjected to strong American pro-V.O.R. pressure. V.O.R. is an excellent aid for regular airliners, but is of less help to any aircraft that do not fly regular routes, and useless to low-flying aircraft and helicopters.

More initials worth mentioning are low-power V.O.R. (L.V.O.R.), of some 50 W power, used to fill gaps in the basic V.O.R. network, and terminal V.O.R. (T.V.O.R.), used to help aircraft arrive at their terminus along a selected radial and to begin circuit or let-down procedure from a known point.

Marconi and Standard Telephones exhibited excellent British V.O.R. at the last S.B.A.C. Exhibition, both operating within the band 112 or 108 to 118 mc/s.

At this point attention can be turned to the development of radar, all the basic systems of which were the result of work carried on in Great Britain between 1935 and 1942. Such systems depend upon the emission of electro-magnetic waves from the aircraft and the reception of either a reflected wave or a signal emitted by a ground station upon receipt of the aircraft transmission. During the war the most important aid to aircraft navigation was undoubtedly Gee, developed at T.R.E., Malvern. This consisted of a master ground station and two slave stations sending out synchronized pulses of radio energy with extreme time-base accuracy. A cathode-ray tube in the aircraft noted the reception of the pulses from the three stations, the time difference between the three receptions giving the position of the aircraft. The first development of Gee was an increase in wavelength to provide wider coverage at some expense in accuracy; this was Loran, largely used by the Americans.

The Decca navigation system is also a distant relative of Gee, but Gee itself is still under intensive development largely by A. C. Cossor, Ltd., who showed two excellent Gee developments at Farnborough last year. The first of these was a lightweight airborne receiver suitable for civil and Service use at all altitudes at which aircraft now fly. The second, known as the Gee Track-Guide system, is a simplified arrangement for use as a poor-visibility aid in the vicinity of airports; two ground stations about

AIRLINE AVIONICS . . .

eight miles apart are used, ideally straddling the airfield.

The Decca Navigator itself is similar in conception to Gee, but operates on the continuous-wave principle. Position-determining with Decca is accomplished by measuring the phase difference between the transmissions from the ground stations, accuracy being extremely high. Further, the system can be utilized at all altitudes down to sea level. Standard Decca presentation is likely to be the company's Flight Log, in which the aircraft track is continuously plotted on a simplified roll map mounted on the pilot's instrument panel. Admittedly, Decca requires the provision of separate airborne receivers, but the excellence of the aid's presentation, its accuracy and the small capital outlay required to provide coverage over large ground areas, far outweigh this disadvantage. Decca is also, of course, used by ships.

Quite a different war-time development was H_2S—the blind-bombing aid. This was an extremely powerful emission of centimetric waves from the aircraft in the form of a thin sheet of waves rotating about a vertical axis so as to sweep over the ground below. The reflected waves were then used to paint a picture on a cathode-ray tube face (television-wise) within the aircraft, showing the terrain below; on this, water appeared black, land areas were lighter, and large buildings and towns produced a bright reflection.

From H_2S has been developed modern cloud/collision warning radar carried in the nose of some modern transports. The tube-face picture of these sets shows the position of high ground and storm clouds in the path of the aircraft. American sets are carried in their latest airliners, and one of the best-known British manufacturers is Ekco. The types E.31 and E.38 of this company are excellent examples of commercially available airborne search radar. Operating at a 3 cm wavelength, the Ekco system is very flexible in operation and, in addition to the aforementioned tasks, can also be tilted downwards to provide position-fixing by map painting of the ground below.

Distance-measuring

Yet another British war-time development was a system of interrogator beacons which respond in a characteristic manner to a signal sent out from an aircraft. The airborne interrogator was named Rebecca and the ground beacon Eureka, the joint equipment being vital in the accurate supplying of resistance movements and the dropping of airborne forces. From Rebecca/Eureka has come modern D.M.E., or distance-measuring equipment. D.M.E. is very useful in conjunction with a V.O.R. network since, although the former can supply bearing information to any aircraft within the network, distances can only be provided by D.M.E. (unless a number of bearings are taken simultaneously to provide crossing position lines). The D.M.E. system is, of course, radar, since it depends on a pulse emitted by the aircraft. This pulse is reflected by the ground V.O.R. station on a different frequency, the resulting "$R\theta$" fixing the aircraft position. To make matters easier, frequency pairing is possible, the aircraft channel selector being dialled to the V.O.R. frequency; then the D.M.E. transmitter operates on the transponder ground receiver channel and the D.M.E. receiver on the transponder transmitter channel. A number of companies manufacture D.M.E. in the U.S.A.; in the U.K. Ferranti, Murphy and Marconi are prominent.

At the last S.B.A.C. exhibition Marconi's showed D.M.E. which had been developed by their associated company, Amalgamated Wireless (Australasia). The equipment operates on two frequencies in the 200/235 mc/s band and employs double pulses for the interrogation and a single pulse for the ground response. Coding is provided by variation in pulse width and spacing, and a total of 12 different beacons can be selected. Presentation is by instrument pointer over a scale graduated variously from 0-10 and 0-100 nautical miles. Auxiliary equipment provides homing facilities in the form of a centre heading line and an orbiting indicator adjustable to a radius of from 1-19 miles.

The Murphy D.M.E. is a lightweight set, very flexible in operation. Single or double pulse interrogation can be provided and the range meter is scaled from 0-20 or 0-200 miles. The ground beacons associated with the Marconi and Murphy sets have a power of 400 and 800 W respectively. Ferranti D.M.E. has undergone considerable airline trials.

In 1940 a research team at Bristol University developed the Skiatron, which was a special cathode-ray tube whose screen was coated with finely ground potassium chloride crystals. Impact of the electron beam produced a black mark on the tube face, which could thus be treated as an epidiascope slide and projected on to a large screen (this was very useful for strategic plotting and large-scale operations). From H_2S, airborne interception (A.I.) radar, the Skiatron tube face and the general technology of the P.P.I.s, or plan position indicators (a form of H_2S painting a picture of the ground surface about the emitting station) have come a whole range of air traffic control devices. These may best be discussed by considering what happens as a modern airliner approaches an international airport in bad weather.

At a range of some 60-200 miles, micro-wave early-warning (MEW) will pick up the incoming airliner as a small "blip" on the traffic controller's tube face. The airliner will be interrogated by the VHF/RT and asked to execute a manœuvre; this will show up on the screen and provide a means of identification. Knowing what each blip represents, the controller will then be able to bring in his traffic in a co-ordinated sequence.

Bad-weather Landings

When the airliner is some 30 miles distant the pilot will be directed to change to a different frequency, namely that used by the terminal area controller. The latter sits at an airport surveillance radar set (A.S.R.), which shows the same picture as the centre of the MEW screen, but on a considerably larger scale. Adjacent to the surveillance radar set will be an installation known in Great Britain as a G.C.A. installation and in the United States as a precision approach radar (P.A.R.). The signal transmitted to the cathode-ray tube of this latter equipment gives the approach controller precise knowledge of the position of the incoming aircraft once it has turned on to its final approach.

If the pilot requests a G.C.A. landing the following sequence of operations takes place : the G.C.A. hut's rotating UHF surveillance aerial puts out a steady sweeping emission—like a lighthouse—which is reflected from the aircraft concerned each time the beam is pointing in the appropriate direction. The position of the aircraft is thus clearly indicated on the P.P.I. scope within the hut. The approach radar uses an even higher frequency—known as super high-frequency, or S.H.F.—in order to provide the most precise definition of the aircraft on the tube face. Two approach radar aerials are used, one of which scans through a 20 deg arc facing downwind along the runway in use, while the other is beamed over the runway centre line and scans through a vertical arc of between 5 and 8 deg to provide glide-path information. As the aircraft approaches the runway any deviations from the ideal glide-path are transmitted back to the pilot over the R/T. Alternatively, the pilot can be ordered by the G.C.A. controller to fly his aircraft in a certain manner and so follow the correct glide-path.

At the same time as position-finding aids were being developed, landing aids were also rapidly being brought to the point where they could ensure a successful landing in all but the very worst conditions. The I.L.S. (instrument landing system) consists of a V.H.F. transmitter, known as a localizer, at the upwind end of the runway in use, emitting a split radio beam whose consecutive halves are keyed together by a Morse transmission of E and T, or A and N, the central zone being a continuous note. Alternatively, the beam may be modulated to 90 cyc/sec on one side and 150 on the other, the notes being continuous. A separate transmission consists of a similar beam turned over on its side to provide glide-path indication.

The I.L.S. receiver on board the aircraft is sensitive to the localizer and glide-path beams, and, according to the position of the aircraft on its approach, feeds signals to crossed needles on one of the pilot's instruments. The needles will cross in the centre of the dial when the aircraft is correctly aligned on the landing run. As the aircraft progresses down the runway it passes over an outer marker about 4½ miles out from touch-down and a middle marker about 4,000ft out; these are short-range fan markers, giving precise indication of distance-to-go.

It will be appreciated that D.M.E. can be integrated with I.L.S., just as it can with V.O.R., the frequencies being paired, using the airfield V.O.R. station as a target. The aircraft is thus provided with continuous range indication throughout its approach. The latest development is a completely automatic bad-weather instrument approach in which the localizer and glide-path signals are fed through an approach coupler to the aircraft autopilot. And P.A.R., previously described, can be used to monitor I.L.S. landings.

Finally, attention may be turned to "Consol," which is an M/F long-distance navigational aid. Three aligned ground station aerials broadcast overlapping 220 deg sectors, the signal consisting of Es and Ts by Morse in groups of a fixed number; according to the position of the aircraft, so will the number of Es and Ts heard vary. Over-water range is up to 800 nautical miles day and night.

The radio compass provides a unidirectional bearing indication, a sense aerial and a receiver detecting the direction of the signal received from a non-directional ground marker beacon. The signal from the compass receiver is fed into one of the pilot's instruments, the needle of which gives the bearing of the ground station from the aircraft. Radio altimeters consist of an ultra-high-frequency transmitter and receiver emitting frequency-modulated continuous waves which are reflected from the ground directly beneath the aircraft. The frequency difference between the outgoing and incoming wave is indicated on the altimeter scale, which, it will be noted, actually measures the height of the aircraft above the ground.

Super priority

Hunter

Super-priority orders have been placed for Sapphire-engined Hawker Hunter F.2 fighters for the Royal Air Force — another example of the part which the Armstrong Siddeley Sapphire turbojet is playing in the defence plans of the Western World

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Jet travel at 500 miles per hour
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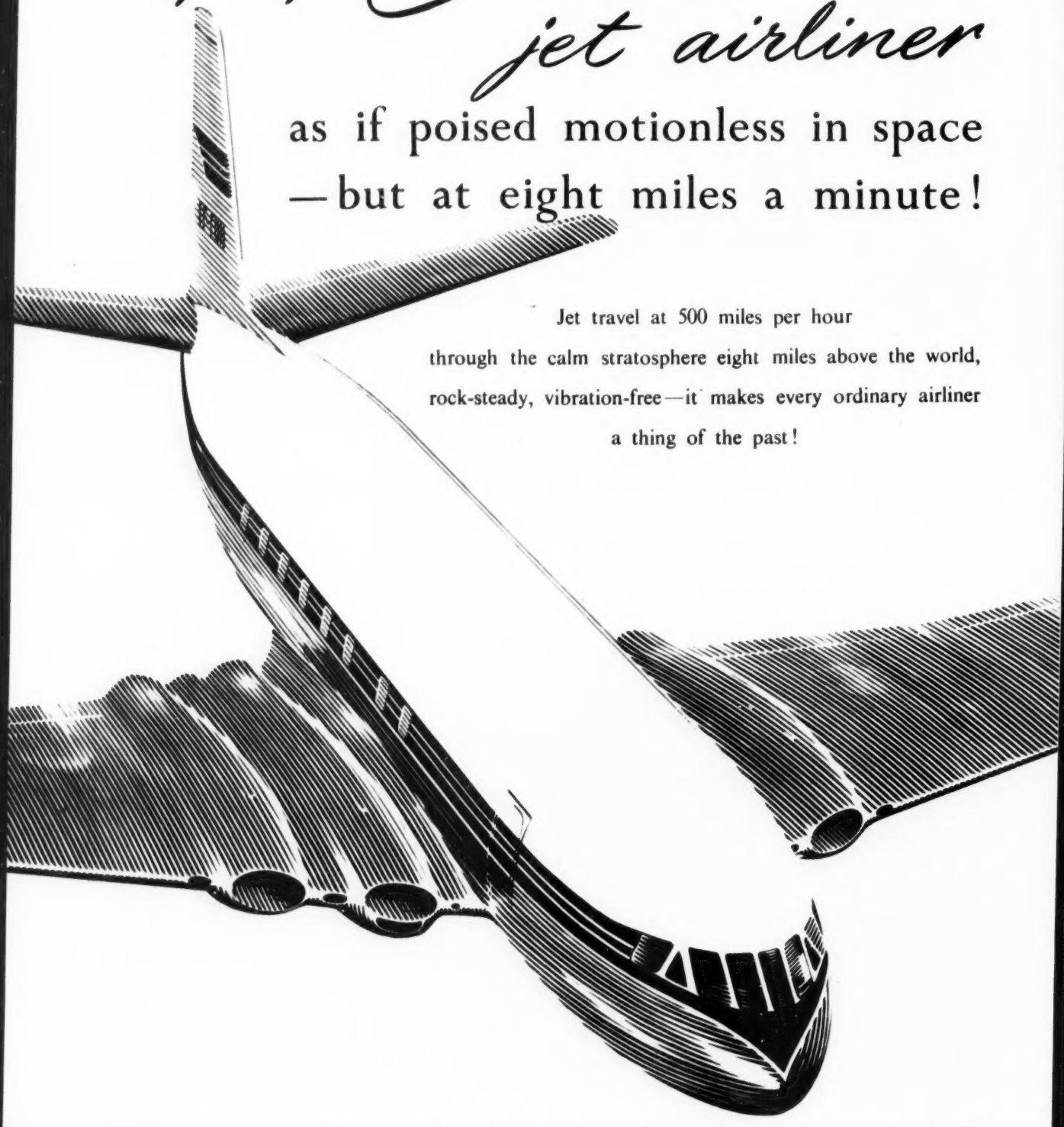

DE HAVILLAND

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COMMERCIAL AIRCRAFT 1953

Britannia 100 (B.O.A.C.).

A NEW generation is growing up today for whom the air is as normal and natural a medium for travel as any of the older surface forms. Already, for example, virtually all trans-Pacific passengers travel by air. Again, there are countries in which more freight is now being carried by aircraft than by all surface vehicles combined. The makers of commercial aeroplanes and their products, which are reviewed on the following pages, are thus being called upon to bear increasing responsibility.

Even the most enthusiastic supporters of the concept of merchant air services failed to foresee the remarkable and rapid expansion in air commerce which has taken place during the last two or three years, and is continuing today. There is a steady demand for new commercial aircraft from almost every country in the world—to extend existing passenger routes and to develop new ones for freight and other traffic. In addition to the market thus created, it should be borne in mind that of all air journeys—as distinct from air ton-miles—flown at the present time, approximately half are handled by aircraft which are over ten years old. The majority of these have none of the modern refinements, nor do they benefit from the advances in engineering and electronics, which are provided, at a price, in the latest designs. Soon these elderly aircraft must be replaced.

In the review which follows, the machines have been treated in classes according to their all-up weight. The range payload figure quoted is that for the optimum condition, i.e., the greatest range possible with capacity payload.

70,000 lb AND ABOVE

AVRO TUDOR • Doing useful work in several parts of the world, the Tudor VB is found as a "non-sked" passenger and cargo aircraft chiefly in Great Britain, South Africa and Canada.

Tudor VB (four Merlin 626, total 7,040 h.p.).—Span, 120ft; length, 105ft; wing area, 1,421 sq ft; gross weight, 80,000 lb; wing loading, 56.5 lb/sq ft, range 1,550 miles at 225 m.p.h. at 17,000 ft with 18,000 lb payload.

AVRO YORK • Nearly 50 are still in airline service, although lack of pressurization has relegated most British Yorks to freighting. British independent operators have many Yorks; Skyways being the largest fleet, of 28 aircraft.

York (four Merlin 500, total 6,440 h.p.).—Span, 102ft; length, 78ft; wing area, 1,297 sq ft; gross weight, 68/70,000 lb; wing loading, 54.5 lb/sq ft; range, 1,300 miles at 210 m.p.h. at 12,000ft with 15,000 lb payload.

BLACKBURN UNIVERSAL • Once the long-awaited military order had been placed (Beverley C.1) the way was cleared for civil production of this 5,760 cu ft freighter. Already Silver City have a firm order booked for three and A.N.A. (Air Beef section) are interested. The prototype has four Hercules 730s but the improved Centaurus version is to be produced.

Universal 2 (four Centaurus 671, total 11,760 h.p.).—Span, 162ft; length, 99ft; wing area, 2,916 sq ft; gross weight, 130,000 lb; wing loading, 43.5 lb/sq ft; range 1,100 miles at 180 m.p.h. at 9,000ft with 40,000 lb payload.

BRISTOL BRITANNIA • This most promising design has, in the event, exceeded expectations. Its structure is the minimum-weight optimum, the aerodynamic-servo, unpowered control system is reputed to be excellent and the Proteus turbines promise even better performance than estimated. The first prototype, designated Britannia 100, is now flying with revised nacelles; long tailpipes provide a total of 4,000 lb thrust. This aircraft will not be submitted for C. of A. testing but the second aircraft —which will fly in July with Proteus 3 engines—will and, after Certification, the M.o.S. may sell it to B.O.A.C. The Corporation already have 30 Britannias on order for delivery in the autumn of 1954. Of these, 25 will be 58- or 92-seater long-range aircraft, probably with forward galley and aft toilets; the other five will be freighters, with a maximum payload of 43,000 lb. Britannia sub-types, incidentally, are: series 200, freighter with 9ft 3in extra fuselage, mostly ahead of the wing; series 300, as 200 but for passengers; and series 310, as 300 but with tip-tanks. At least 150,000 lb is foreseen as the standard all-up weight, wing strengthening for this, and greater, weights exacting little weight penalty. I.C.A.O. "critical engine out" requirements can be met at no less than 8,000ft and engine handling is excellent. The Proteus 3 is already giving 4,380 e.h.p. and is six per cent under its predicted s.f.c. Bristols can thus keep 10 per cent power in reserve for the time being. Britannia production is expected to be two per month at Bristol, possibly paralleled by a second British source. And there is no reason to disbelieve American reports of possible production by Canadair.

Britannia 100 (four Proteus 705, total 16,000 e.h.p.).—Span, 140ft; length, 114ft; wing area, 2,055 sq ft; gross weight, 140,000 lb; wing loading, 68 lb/sq ft; range up to 2,000 miles at 395 m.p.h. or about 4,000 miles at 365 m.p.h. at higher altitude with 92 passengers.

Comet 1A (C.P.A.).

Commercial Aircraft 1953 . . .

DE HAVILLAND COMET • Comet hours are now approaching 20,000 and the batch of 21 Mk 1 and 1A aircraft is nearly complete. B.O.A.C. have received nine; the remainder are for U.A.T., Air France, the M.o.S., the R.C.A.F. and C.P.A. Construction is proceeding on Mk 2s for B.O.A.C., B.C.P.A., J.A.L., L.A.V. and other operators, and parts are being made for the first Mk 3 aircraft, which is due to fly next year. Exceptional care has been taken to ensure that the first Comets are safe and reliable aircraft. No machine has been subjected to a more exacting programme of trials and proving flights. The fact that Mk 1s are operating at very high load factors, and alone of all transports attract a long passenger waiting list, is not due merely to novelty value so much as to their genuine and widely recognized passenger appeal. Contrary to some predictions, they are making money for B.O.A.C. on the South African and Far Eastern routes, and they will soon be operating over France, West Africa and the North Pacific between Vancouver and Hong Kong. The Comet is fortunate in that a whole range of excellent engines is becoming available to keep in step with developments in the basic airframe. As the engine power available increases so does the fuel consumption; but the greater working rates of the Mks 2 and 3 more than offset this. In fact, on a ton-miles per gallon basis, the Mk 3—which will weigh as much as a Stratocruiser—should prove twice as efficient as the Mk 1. Above all, it cannot be over-emphasized that the Comet is a straightforward, modern transport, capable of operation from almost all major airfields and posing no special problems in the maintenance, aerodynamic or operational fields. Altogether, it is thoroughly worthy of its historic role as the first of the new era of transport aircraft.

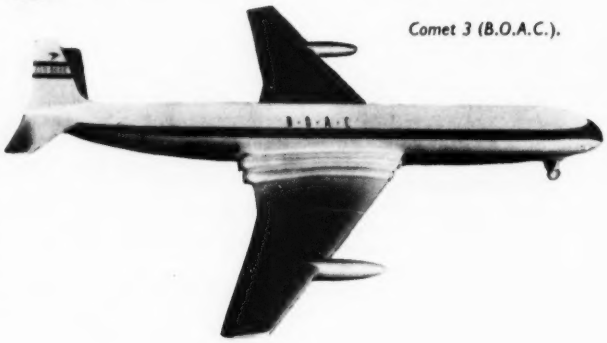
Comet 1A (four Ghost 50, total 20,000 lb thrust).—Span, 115ft; length, 93ft; wing area, 2,015 sq ft; gross weight, 110,000 lb; wing loading, 54.5 lb/sq ft; range 2,700 miles at 465 m.p.h. at 35,000ft with 12,000 lb payload.

Comet 2 (four Avon 500 series, total 26,000 lb thrust).—Span, 115ft; length, 96ft 11in; wing area, 2,015 sq ft; gross weight, 120,000 lb; wing loading, 57 lb/sq ft; range, 3,600 miles at 490 m.p.h. at 40,000ft with 13,500 lb payload.

Comet 3 (four Avon, total 36,000 lb thrust).—Span, 115 ft; length, 111ft; wing area, 2,015 sq ft; gross weight, 145,000 lb; wing loading, 72 lb/sq ft; range 4,500 miles at 520 m.p.h. at over 40,000ft with 17,500 lb payload (estimated).

Comet 2 (Panair do Brasil).

Comet 3 (B.O.A.C.).



HANDLEY PAGE HERMES 4 • Regarded by many as the most comfortable of all piston-engined transports, the Hermes is being progressively replaced by Comets on B.O.A.C. routes. Of the Corporation's 25, 19 are left of which some (perhaps as many as a dozen) are for sale. Airwork have used Hermes on trooping work, with over 60 aft-facing seats apiece.

Hermes 4 (four Hercules 763, total 8,400 h.p.).—Span, 113ft; length, 96ft 10in; wing area, 1,408 sq ft; gross weight, 86,000 lb; wing loading, 61 lb/sq ft; range 2,600 miles at 235 m.p.h. at 13,000ft with 15,000 lb payload.

SAUNDERS-ROE PRINCESS • Biggest and heaviest aircraft ever built outside America, the Princess is a magnificent engineering achievement. It is, therefore, doubly unfortunate that no firm decision has yet been announced for operational use of these great boats. One has been flying since last summer with Proteus 605 series engines; the remaining two have been stored in a protective coating awaiting the availability of the more powerful Proteus 3. At the moment, although Princess No. 1 is producing very valuable research data, it is not certain that the type will see scheduled commercial service.

Princess (ten Proteus 705, total 40,000 h.p.).—Span, 219ft 6in; length, 148ft; wing area, 5,000 sq ft; gross weight, over 315,000 lb; wing loading, over 63 lb/sq ft; range, 4,200 miles at 355 m.p.h. at 35,000ft with 40,000 lb payload.

SHORT S.45 SOLENT • Last main-line survivor of the great Short airline flying-boat family, the Solent is giving fine service on the routes of T.E.A.L., T.O.A., and Aquila. The

Hermes 4 (B.O.A.C.).

Universal.

DC-6B (Swissair).

DC-6A (Slick).

Tasman aircraft are fitted to accommodate 42 passengers in five cabins; three of these cabins are on the lower deck, where there are also found dressing rooms, cocktail bar, promenade deck and toilets. Earlier Sandringhams and Hythes are also in commercial service.

Solent 2 (four Hercules 733, total 8,160 h.p.).—Span, 112ft 9in; length, 88ft 7in; wing area, 1,687 sq ft; gross weight, 78,000 lb; wing loading, 46.3 lb/sq ft; range 1,800 miles at 200 m.p.h. at 8,000ft with 15,000 lb payload.

CANADAIR C.4 • Known as the *Argonaut*-class (26) in B.O.A.C. and the *North Star*-class (20) in T.C.A. the type is a cross-bred DC-4/DC-6 pressurized airframe powered with high-altitude Merlin two-stage engines. The result is a very efficient aircraft, whose only drawback—noise—has now been overcome in both airlines by fitting revised exhaust systems. It flies most B.O.A.C. routes to S. America and Japan, and operates from London to the Pacific with T.C.A.

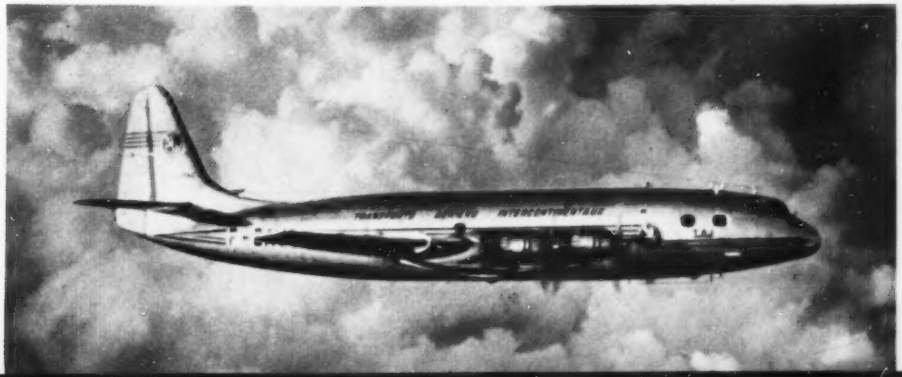
C.4 Argonaut (four Merlin 724 TMO, total 7,200 h.p.).—Span, 117ft 6in; length, 93ft 7½in; wing area, 1,457 sq ft; gross weight, 80,200 lb; wing loading, 55.1 lb/sq ft; range, 2,600 miles at 255 m.p.h. at 18,000ft with 12,000 lb payload.

BREGUET 76 PROVENCE • This is a genuine "Deux Ponts," with 55ft of cabin on the upper deck and 43ft usable down below. Electric hoists serve both decks, loading being effected *via* the large rear doors shown in the photograph on page 296. The 76-1 is used by Air Algerie (p. 298) and Air France have twelve 76-3s. The latter are more powerful aircraft with reversing airscrews. Air France has them fitted to carry 59 on the upper deck, the lower deck being divided into a freight hold and a 49-seat cabin.

Breguet 76-3 (four Double Wasp R-2800 CA-18, total 9,600 h.p.)—Span, 141ft; length, 95ft; wing area, 1,996 sq ft; gross weight, 110,000 lb; wing loading, 55 lb/sq ft; range 1,700 miles at 215 m.p.h. at 10,000ft with 23,980 lb payload.

S.E.2010 ARMAGNAC • Although little known, the Armagnac is the biggest and heaviest airliner ever placed in service, its general proportions being well shown on page 298. One can now buy a ticket for an Armagnac service on Air France and T.A.I. and enjoy a comfortable, quiet ride in a 107-passenger pressurized interior. This is a fitting reward to the effort put into the S.E.2010, so many ambitious French projects having fallen by the wayside. Transports Aeriens Intercontinentaux have three Armagnacs and Air France are steadily receiving their order of eight. Much experimental work has been done with the type; this may be continued with a Proteus-powered fifteenth aircraft. The Armagnac would benefit from additional power.

S.E.2010 (four Wasp Major R-4360-B13, total 14,200 h.p.).—Span, 160ft 6¼in; length, 129ft 11in; wing area, 2,539 sq ft; gross weight, 165,000 lb; wing loading, 65 lb/sq ft; range 2,400 miles at 250 m.p.h. at 15,000ft with 26,000 lb payload.



Armagnac (T.A.I.).

DC-4 Freighter (P.A.W.A.).

COMMERCIAL AIRCRAFT 1953 . . .

BOEING 377 • Although it was originally a converted bomber, superlatives come easily to the Stratocruiser. No other airliner has such massive servicing manuals, such lengthy check lists or such a towering flight deck. And, until the advent of the British turbine airliners, none has been so fast or so quiet. Fifty-six Boeings were built, all of which were delivered in 1949. Since then several hundred military derivatives have gone to the U.S.A.F. as tankers, transports and hospital ships. B.O.A.C.'s Model 377-10-32 has 60 seats in the upper "bubble" and a 12-seat lounge and bar on the lower deck, along with an 845-cu ft freight hold. Other operators are PanAm, United and NorthWest.

Boeing 377 (four Wasp Major R-4360 TSB-3G, total 14,000 h.p.).—Span, 141ft 3in; length, 110ft 4in; wing area, 1,769 sq ft; gross weight, 145,800 lb; wing loading, 82.5 lb/sq ft; range 3,000 miles at 310 m.p.h. at 25,000ft with 24,500 lb payload.

DOUGLAS DC-4 • Some 570 are in use in all parts of the world. Of these, however, only 74 are genuine post-war civil DC-4s, the remainder being C-54s released, sold or leased by the U.S. Government. The unpressurized cabin usually seats about 44 passengers.

DC-4 (four Twin Wasp R-2000 2SD13-G, total 5,800 h.p.).—Span, 117ft 6in; length, 93ft 11in; wing area, 1,461 sq ft; gross weight, 73,000 lb; wing loading, 49.9 lb/sq ft; range 2,100 miles at 200 m.p.h. at 12,000ft with 17,000 lb payload.

DOUGLAS DC-6 • Just as the original DC-4, of pre-war conception, exactly fitted the requirements of the period for which it was designed, so have the Douglas company developed from it a whole range of more powerful transports which have proved themselves "just what the customer wanted" during the past seven years. This has been achieved by an unprecedented "beefing and stretching" process, in the course of which engine power and all-up weight have been doubled without fundamentally altering the basic airframe. Just how great an advance has been made is indicated by comparing the data for the DC-4 (above) with that for, say, the DC-6A (Col. 2). An important factor in permitting such progress was the fitting of large, double-slotted flaps. The original DC-6 appeared in 1946 and the type immediately went into large-scale production; 177 in all were built. These aircraft normally carry 50 to 58 passengers. The DC-6A Liftmaster marked an increase in length to 105ft 7in in order to accommodate bulky freight. Two large loading doors are provided and a 4,000 lb hoist is standard equipment. A major advance in the -A was the installation of up-rated Double Wasp engines with paddle-blade airscrews. The DC-6B is the passenger version of the Liftmaster, with seats for between 64 and 92 passengers. PanAm have a fleet of 39 on 85-seat tourist services. All DC-6s are pressurized, and the usable cabin length is—in the -A and -B—72ft 5in. Several -As have been delivered, together with 102 -Bs; 44 of the latter remain on order, together with over 100 military versions (R6Ds and C-118s), the latter being very useful in maintaining the price at the $1 m level.

DC-6 (four Double Wasp R-2800-CA15, total 9,600 h.p.).—Span, 117ft 6in; length, 100ft 7in; wing area, 1,463 sq ft; gross weight, 97,200 lb; wing loading, 66.4 lb/sq ft; range, 4,200 miles at 275 m.p.h. at 18,000ft with 14,800 lb payload.

DC-6A (four Double Wasp R-2800-CB17, total 10,000 h.p.).—Span, 117ft 6in; length, 105ft 7in; wing area, 1,463 sq ft; gross weight, 107,000 lb; wing loading, 73 lb/sq ft; range, 3,720 miles at 310 m.p.h. at 26,000ft with 30,513 lb payload.

DC-6B (four Double Wasp R-2800-CB17, total 10,000 h.p.)—Span, 117ft 6in; length, 105ft 7in; wing area, 1,463 sq ft; gross weight, 107,000 lb; wing loading 73 lb/sq ft; range, 3,720 miles at 315 m.p.h, at 20,000ft with 18,488 lb payload.

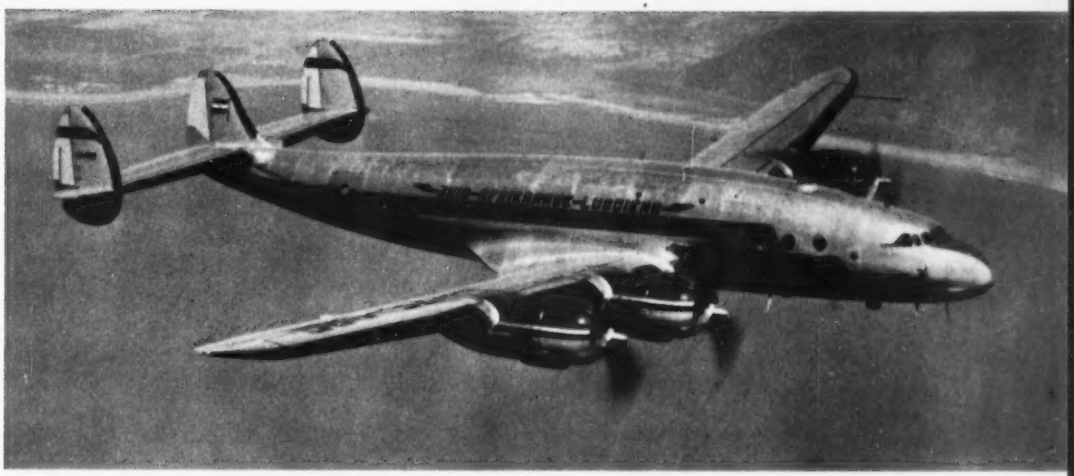
DOUGLAS DC-7 • Pinnacle of the greatest transport family of all time, the DC-7 is certain to be the last Douglas piston-engined transport of its size. Basically a DC-6B with added fuselage length, the "seven" is powered by the Wright Turbo-Compound engine, which offers nearly three times the power of the original DC-4. Titanium is prevalent in the DC-7 airframe, although the empty weight is 10,000 lb greater than that of the DC-6B. Principal operators of the type will be American Airlines and United. The wing and fuselage of the first aircraft were joined last month. Other DC-7 operators will be Sabena and K.L.M., to whose long-stage routes the new airliner will be well suited. Nevertheless, the day of the piston-engined airliner is passing, for even the president of United Air Lines has stated that the DC-7 will be depreciated over an unusually short period, owing to the incidence of turbojet transports.

DC-7 (four Wright R-3350 DA1, total 13,000 h.p.).—Span, 117ft 6in; length, 108ft 11in; wing area, 1,463 sq ft; gross weight, 122,200 lb; wing loading, 83.7 lb/sq ft; range (estimated) 4,325 miles at 340 m.p.h. at 27,000ft with 19,367 lb payload.

DC-7 (A.A.).

Provence (Air France).

(Above) Super Constellation (T.W.A.).



Constellation (S.A.A.).

Stratocruiser (N.W.A.).

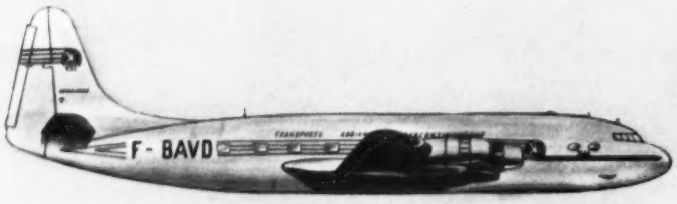
LOCKHEED CONSTELLATION • The beautiful Constellation will probably be remembered as the "Queen Mary" of piston-engined transports. Originally designed in the 1939-1940 period, the first civil "Connie"—model 49D—was a conversion of the military C-69, with minor modifications. The 649, as used by B.O.A.C., incorporated new direct-injection engines and many interior and airframe alterations. The 749 embodied outer-wing tanks which took the gross weight to 102,000 lb while the 749A also featured new undercarriage details to raise this by a further 5,000 lb. Up to this point 206 Constellations were delivered, the majority being 55 or 60 seaters. A major "stretch" produced the Model 1049 Super Constellation, the added length being no less than 18ft 5in. At the same time, cabin pressure differential was increased, and a new cockpit canopy was fitted, together with square passenger windows and optional centre-section tanks. The 1049B freighter is powered with the Wright Turbo-Compound engine, designed to further the Constellation's operating economy. This aircraft has large loading doors fore and aft and also introduces advanced constructional methods—which include integrally-stiffened, machined lower wing panels and extruded magnesium floor. Many will go to the U.S.A.F. and U.S.N. As a passenger aircraft, with up to 110 seats, it becomes the 1049C. K.L.M. are to have the first batch of 1049Cs; the first flew in February. Total order backlog is some $250,000,000. "Beefing-up" then produces the 1049E, of 150,000 lb all-up weight and, finally, about 1957 should see the 1249 turboprop Constellation available. With shorter span and tip-tanks—as compared with the 1049E—the 1249A and B are, respectively, for freight and passenger work. Extremely advanced airscrews will be used, with "the widest blades ever built." The first T-34-powered aircraft will be styled R7V-2, for the U.S. Navy. It may fly this year.

Constellation 749A (four Wright R-3350-BD-1, total 10,000 h.p.).—Span, 123ft; length, 95ft 1½in; wing area, 1,650 sq ft; gross weight, 107,000 lb; wing loading, 64.8 lb/sq ft; range 3,100 miles at 290 m.p.h. at 20,000ft with 17,300 lb payload.

Constellation 1049C (four Wright R-3350 DA1, total 13,000 h.p.).—Span, 123ft; length, 113ft 7 in; wing area, 1,650 sq ft; gross weight, 130,000 lb; wing loading, 78.8 lb/sq ft; range 3,700 miles at 320 m.p.h. at 27,000ft with 22,500 lb payload.

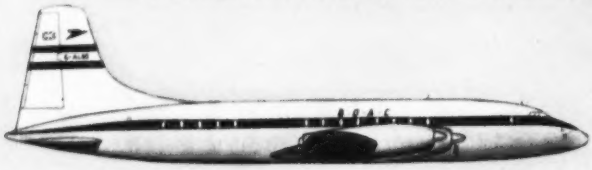
Constellation 1249B (four Pratt and Whitney T-34P, total probably about 22,000 h.p.).—Span, 117ft; length, 113ft 7 in; wing area, 1,615 sq ft; gross weight, 150,000 lb; wing loading, 92.9 lb/sq ft; range (estimated) 3,600 miles at 385 m.p.h. at 30,000ft with 22,500 lb payload.

Transports of the Merchant Air Fleets:



Armagnac (Compagnie de Transportes Aériens Intercontinentaux)

Martin 4-0-4 (Trans-World Airlines)



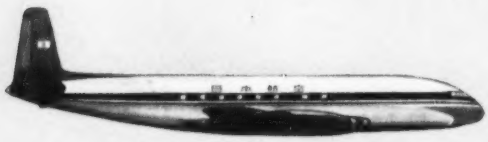
Britannia 100 (British Overseas Airways Corporation)

Bretagne (Air Maroc)

Constellation 749 (Qantas Empire Airways)

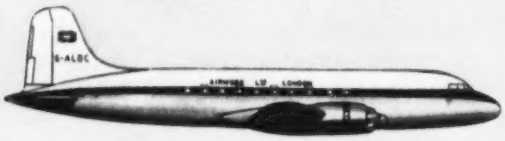
Comet 1a (Union Aéromaritime de Transport)

Comet 3 (Pan American World Airways)



Comet 2 (Japan Air Lines)

Scandia (Scandinavian Airlines System)

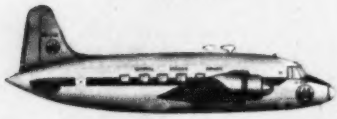


Hermes 4 (Airwork)

Provence (Air Algerie)

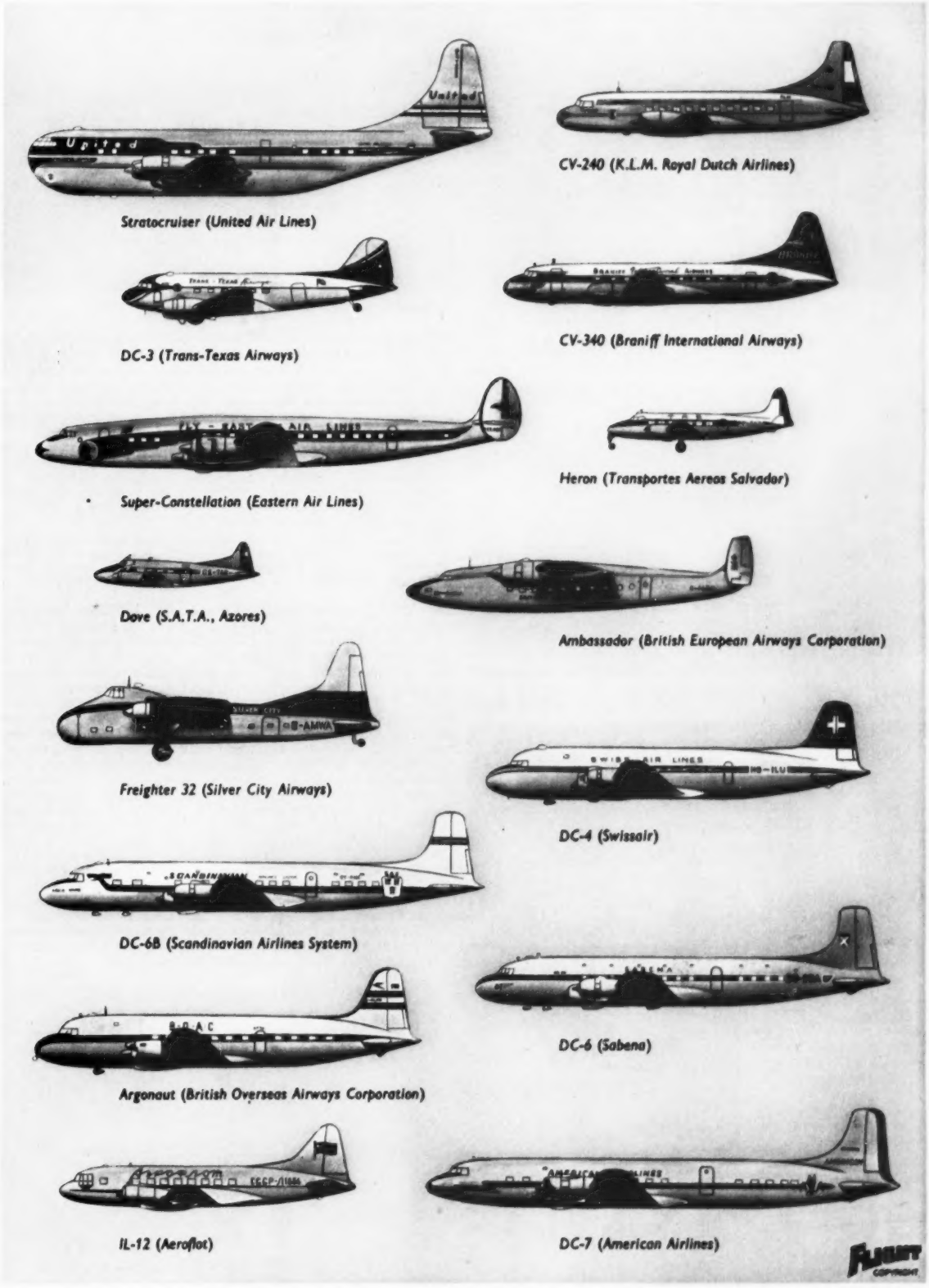
Marathon (Union of Burma Airways)

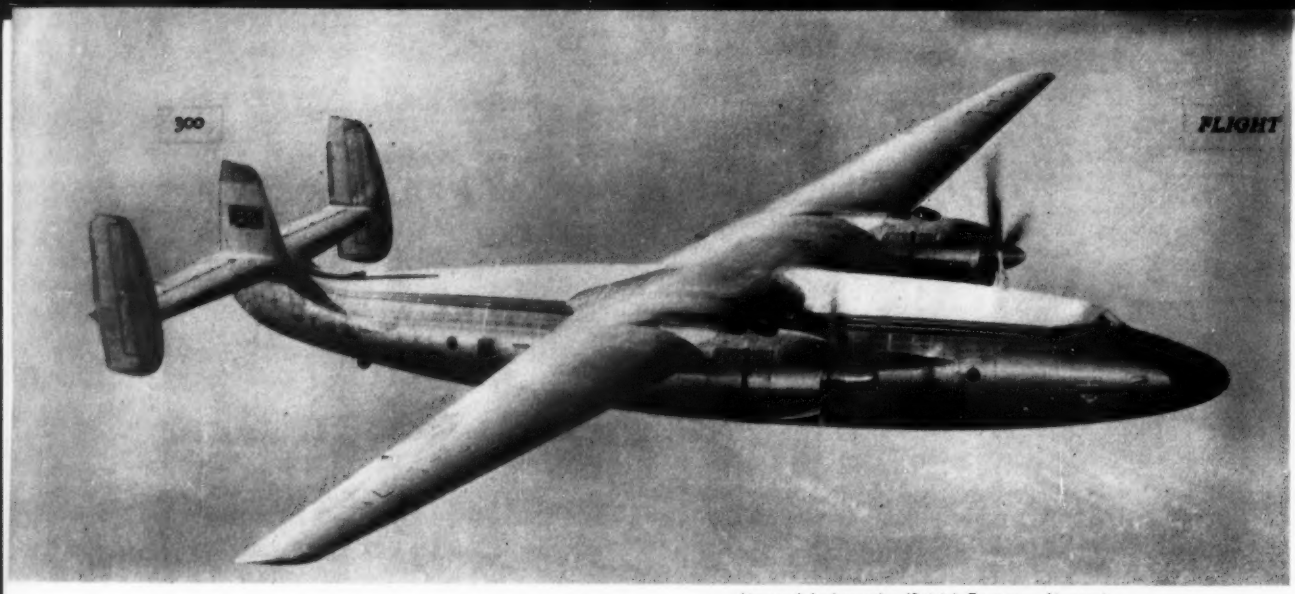
Viscount 708 (Air France)



Viking (Central African Airways Corporation)

Representative Airliners Drawn to Scale

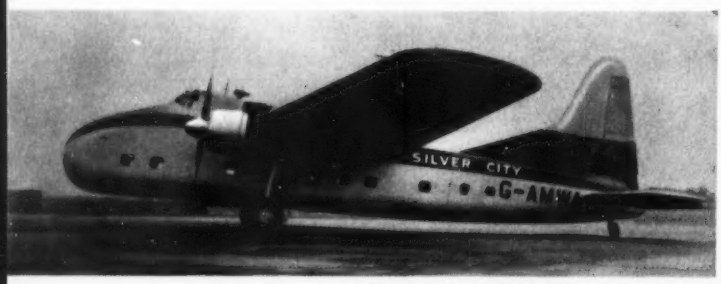




Airspeed Ambassador (British European Airways).

Commercial Aircraft 1953 . . .

12,500 to 70,000 lb.



Bristol Freighter Mk 32 (Silver City Airways).

De Havilland Heron.

Vickers Viking (British European Airways).

AIRSPEED AMBASSADOR • Bringing a new standard of passenger comfort to the many continental routes on which they are now flying, B.E.A.'s 47-seat Elizabethan-class Ambassadors have proved deservedly popular with the air-travelling public. The impressive view from below the high-mounted wing and the wide, spacious interior appearance are main factors in this popularity.

Although introduced into scheduled airline service much later than expected, due to delivery delays, the type is now making an effective and economic contribution to B.E.A.'s operations. In particular, between London and Paris, on what was the Elizabethan's first scheduled route, the luxury "Silver Wing" service is now resulting in high load factors.

A.S. 57 Ambassador (two Centaurus 661, total 5,200 h.p.).—Span, 115ft; length 82ft; wing area, 1,200 sq ft; gross weight, 52,500 lb; wing loading, 43.3 lb/sq ft; range 1,220 miles at 242 m.p.h. at 20,000ft with 7,600 lb payload.

BRISTOL 170 FREIGHTER • Of distinctly utilitarian appearance, the homely Freighter has proved its worth in all parts of the globe where large and bulky freight has to be carried with regularity over medium stage-lengths. It is used by A.N.A. on the Australian "Air Beef" scheme, and the pioneers of cross-Channel car-ferry work, Silver City Airways, have found in the Mk 31 Freighter an aircraft well suited to their specialized needs—its operating economy well proved by this year's drastic fare reductions and consequent traffic increase. To the order of this firm Bristols have developed and built the Mk 32 "long-nosed" version, illustrated on this page, which recently completed all its full C. of A. tests in only ten hours' flying.

Mk 31 Freighter (two Hercules 734, total 4,000 h.p.).—Span, 108ft; length, 68ft 4in; wing area, 1,487 sq ft; gross weight, 44,000 lb; wing loading, 29.5 lb/sq ft; range, 800 miles at 160 m.p.h. at 5,000ft with 11,000 lb payload.

DE HAVILLAND HERON • A development of the Dove, the four-engined Heron was designed especially for simplicity of operation and maintenance, and intended for feederline routes. A fixed undercarriage was the unusual feature on all early models, but an alternative version (seen in the photograph) with retractable landing-gear is now available, and flew for the first time in

Vickers Viscount 701 (British European Airways).

December last. Herons have been ordered by operators in Norway, New Zealand, Australia, Brazil, Japan and Indonesia. From 14 to 17 passengers are carried.

D.H. 114 Heron (four Gipsy Queen 30-2, total 1,000 h.p.).—Span, 71ft 6in; length 45ft 6in; wing area, 487 sq ft; gross weight, 12,500 lb; wing loading, 25.7 lb/sq ft; range, 400 miles at 160 m.p.h. at 8,000ft with 3,420 lb payload.

HANDLEY PAGE (READING) MARATHON • Originally a Miles design, this short- and medium-range feederline transport carries 18-22 passengers. Three Marathons were delivered to West African Airways in October, 1952, and machines of this type are also operated by Union of Burma Airways.

Marathon 1 (four Gipsy Queen 70-4, total 1,380 h.p.).—Span, 65ft; length, 52ft 1½in; wing area, 498 sq ft; gross weight, 18,000 lb; wing loading, 36.14 lb/sq ft; range, 810 miles at 167 m.p.h. at 5,000ft with 4,260 lb payload.

VICKERS-ARMSTRONGS VISCOUNT 700 • Developed by Vickers in close collaboration with B.E.A., the Viscount is to enter scheduled service on the London-Nice-Rome-Athens-Istanbul route in but a few weeks' time. As the world's first turboprop airliner, the Viscount has been the subject of much interest among potential operators, and this has been reflected in orders from Air France, Trans Canada Airlines, T.A.A. and Aer Lingus, in addition to the 26 for B.E.A. The Corporation's extensive series of experimental proving flights and trial passenger services have shown a marked economy and reliability from Viscount operations, while from the passenger viewpoint the smoothness of flight and the wide-visibility windows are of exceptional appeal. Normal seating is for 48, with provision for up to 62 on tourist services.

V.C. 2 Viscount 700 Series (four Dart R.Da 3, total, 5,400 h.p. + 1,460 lb thrust)—Span, 93ft 8½in; length, 81ft 2in; wing area, 963 sq ft; gross weight, 58,500 lb; wing loading, 60.75 lb/sq ft; range, 800 miles at 300 m.p.h. at 20,000ft with 13,600 lb payload.

VICKERS-ARMSTRONGS VISCOUNT 800 • For future high-density services over the shorter stage-lengths, this Viscount development has already been ordered (12 machines, plus an option on eight more), by B.E.A. With more powerful Dart power units, and a longer fuselage, the 800 will carry from 66 to 82 passengers—the Corporation's layout featuring probably 73 seats. Delivery is expected in 1955.

V.C. 2 Viscount 800 Series (four Dart R.Da 5, total 6,160 h.p. + 1,600 lb thrust)—Span, 93ft 8½in; length, 94ft 6in; wing area, 963 sq ft; gross weight, 65,000 lb; wing loading 67.5 lb/sq ft; range, 500 miles at 290 m.p.h. at 16,000ft with 15,000 lb payload.

VICKERS-ARMSTRONGS VIKING • Designed as an interim-type aircraft to fill the immediate post-war gap, the Viking has performed steady service for B.E.A., the independents and other airlines since its introduction in 1946. Early Mk 1A and 1 types were followed in 1947 by the "long-nosed" 1B, which became the standard version. A total of 115 machines of this type were manufactured, including one experimentally fitted with Rolls-Royce Nene turbojets. Latest development in B.E.A. service is the *Admiral*-class conversion, which has increased the capacity from 27 seats to 38 for tourist operation.

V.C.1 Viking (two Hercules 634, total 3,380 h.p.).—Span, 89ft 3in; length, 65ft 2in; wing area, 882 sq ft; gross weight, 34,000 lb; wing loading, 38.5 lb/sq ft; range, 1,130 miles at 210 m.p.h. at 8,000ft with 7,750 lb payload.

Vickers Viscount 800.

HUREL-DUBOIS HD-31 and 32 • First flown on January 27th the HD-31, is the prototype of a cargo-carrying transport with wings of unusually high aspect ratio (20.2). It has been developed from the successful single-seat HD-10. Great economy and simplicity of operation are expected from the more powerful HD-32, now under construction, which will carry up to 42 passengers, or 11,025 lb freight payload.

HD-32 (two R-1830 Twin Wasps, total 2,400 h.p.).—Span, 147ft 7in; length, 72ft 1in; wing area, 1,076.4 sq ft; gross weight (freight), 38,260 lb; range, 1,240 miles at 168 m.p.h. at 10,000ft with 8,820 lb freight.

S.N.C.A.S.E. 161 LANGUEDOC • Of pre-war design, the first Languedoc flew in 1939, but production was not continued until after the liberation of France. With initially 40 Languedocs in its fleet, Air France has since flown an impressive total of hours on the type, and still retains 15.

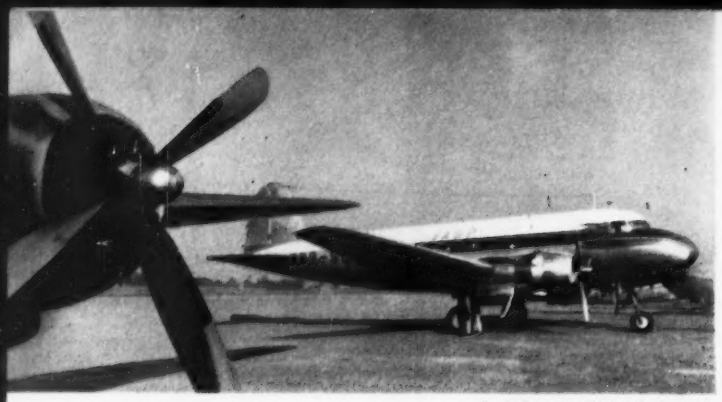
S.E. 161 Languedoc (four Pratt and Whitney Twin Wasps, total 4,880 h.p.).—Span, 96ft 5in; length, 79ft 7in; wing area, 1,198 sq ft; gross weight, 45,360 lb; wing loading, 37.86 lb/sq ft; range, 1,420 miles at 233 m.p.h. at 7,500ft with 8,100 lb payload.

S.N.C.A.S.O. 30P BRETAGNE • Recently demonstrated in this country was the 43-seat version of the Mk 1 Bretagne. Both this type and the Mk 2 (with more powerful R-2800 CA-18 engines) are available also in the 30-seat luxury version. The President of the French Republic, M. Auriol, possesses a specially equipped Bretagne for his personal use, and other operators include Air-Algerie, Air Maroc and S.T.A.E-O.

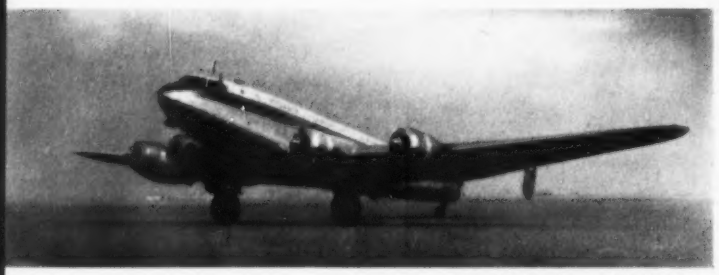
S.O. 30 P-1 Bretagne (two Pratt and Whitney R-2800 B43, total, 4,000 h.p.).—Span 88ft 2in; length, 62ft 2in; wing area, 928 sq ft; gross weight, 43,000 lb; wing loading, 46.4 lb/sq ft; range, 620 miles at 258 m.p.h. at 20,000ft with 8,200 lb payload.

JUNKERS Ju 52/3M • This ageing three-engined German machine is still to be found carrying passengers, mail and freight on the minor air routes of the world. One scheduled route is that from Malmö, Sweden, to Copenhagen, flown with Ju 52s by Ahrenbergsflug under agreement with S.A.S.

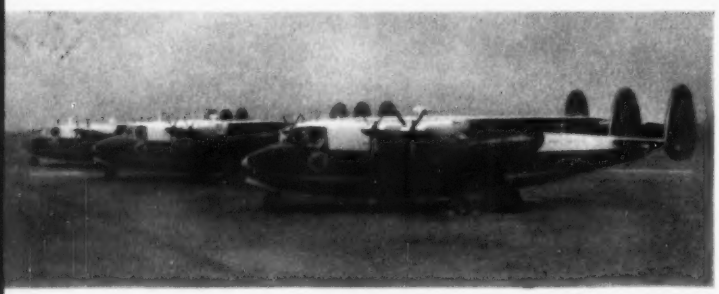
Ju 52/3M (three B.M.W. 132 L, total 2,280 h.p.).—Span, 95 ft 11in; length, 62ft; wing area, 1,190 sq ft; gross weight, 23,200 lb; wing loading, 19.47 lb/sq ft; range, 1,000 miles at 149 m.p.h. at 9,800ft.



Saab Scandia (V.A.S.P., Brazil)



S.N.C.A.S.E. Languedoc (Misrair)



Handley Page Marathon (West African Airways)

Commercial Aircraft 1953 . . .

FIAT G.212 • A tri-motor type is the post-war Italian G.212, built as an interim type immediately after the war, but following in general appearance the typical Italian transports of earlier days. From 26 to 34 passengers are carried; there is also an alternative freight version.

G.212 (three Pratt and Whitney Twin Wasp, total 3,645 h.p.).—Span, 96ft 4in; length, 75ft 7in; wing area, 1,252 sq ft; gross weight, 39,600 lb; wing loading, 31.67 lb/sq ft; range, 1,150 miles at 194 m.p.h. at 10,000ft with 7,800 lb payload.

SIAI-MARCHETTI S.M.95 • Powered by Twin Wasps, as are the majority of present-day Italian transports, the S.M.95 is the only four-engined airliner produced in Italy to enter post-war airline service. From 30 to 38 passengers are carried, depending on the stage-length.

S.M.95 (four Twin Wasp, total 4,860 h.p.).—Span, 112ft 5in; length, 81ft 3in; wing area, 1,380 sq ft; gross weight, 52,870 lb; wing loading, 36.7 lb/sq ft; range, 1,200 miles at 191 m.p.h. at 11,500ft with 9,600 lb payload.

ILYUSHIN IL 12 • This twin-engined machine is the standard medium-range transport of Aeroflot, Czechoslovak Airlines and Polish Airlines, and exhibits orthodox but modern design features. It is unpressurized, and seats 27-32 passengers.

IL 12 (two Ash-82 FNV, total 3,550 h.p.).—Span, 104ft; length, 69ft 11in; gross weight, 38,000 lb; range, 780 miles at 215 m.p.h. at 8,000ft with 32 passengers and 1,440 lb baggage.

YAKOVLEV YAK-16 • In appearance somewhat like a scaled-down Viking, the Russian Yak-16 is in wide use as a short-range feederliner on Aeroflot routes. It accommodates ten passengers.

Yak-16 (two Ash-21, total, 1,500 h.p.).—Span, 65ft 7in; length, 47ft 6in; gross weight, 14,100 lb; range, 620 miles at 180 m.p.h. at 5,600ft with 3,000 lb payload.

SAAB-90 SCANDIA • Now frequently seen in the colours of Scandinavian Airlines System at most of Europe's main airports, the Scandia was designed in 1944 as Sweden's DC-3 replacement, and first flew in 1946. Two interchangeable seating layouts carry 24 and 32 passengers respectively. In addition to the Scandias belonging to the S.A.S. fleet, several are in use with the Brazilian airline V.A.S.P.

Saab-90 A-2 Scandia (two Twin Wasp, total 3,600 h.p.).—Span, 91ft 10in; length, 69ft 11in; wing area, 922 sq ft; gross weight, 35,280 lb; wing loading, 38 lb/sq ft; range, 900 miles at 242 m.p.h. at 10,000ft with 12,700 lb payload.

CONVAIR CV-240 • Possibly the most significant American short-/medium-stage transports since the DC-3, the two Convair models have found their way into the fleets of many international airlines, as well as those of a large number of U.S. domestic operators. The 240 first flew in March, 1947, received C.A.A. certification only eight months later, and was selected by 15 airlines to the total tune of 170 machines, each capable of carrying 40 passengers. Largest Convair-operator is American Airlines, with a fleet of 79; of non-U.S. lines, K.L.M., Sabena and Trans-Australia Airlines possess 12, six and five respectively.

CV-240 (2 CA-18 Double Wasp, total 4,800 h.p.). Span, 91ft 9in; length, 74ft 8in; wing area, 817 sq ft; gross weight, 41,790 lb; wing loading, 51.2 lb/sq ft; range, 920 miles at 272 m.p.h. at 16,000ft with 8,150 lb payload.

CONVAIR CV-340 • The model 340, a larger and more capacious version of the 240, made its initial flight in October, 1951, and was certificated in March, 1952. To date, orders have been placed for at least 175 machines, including 55 for United Airlines and six for K.L.M. Forty-four passengers are accommodated in the standard version of the 340's longer fuselage, while the increased span enables 500 gallons of extra fuel to be carried. The narrow internal cabin-width makes a decrease in seat-pitch necessary for high-density seating; by this means, up to 56 can be accepted in the 340.

CV-340 (two CB-16 Double Wasp, total, 4,800 h.p.).—Span, 105ft 8in; length, 79ft 2in; wing area, 920 sq ft; gross weight, 48,000 lb; wing loading, 52.2 lb/sq ft; range, 750 miles at 284 m.p.h. at 18,000ft with 11,200 lb payload.

CONVAIR CATALINA AND CANSO • The range and reliability of the Catalina, as shown during its wartime duties with Coastal Command, have proved equally desirable on civil transport work, and many are still in use in widely scattered parts of the world. The Canso, an amphibian development, is still operating also, especially in Canada, South America and the Far East, carrying freight and up to 22 passengers.

Model 28-5A Canso (two Twin Wasp, total 2,400 h.p.).—Span, 104ft; length, 68ft 7in; wing area, 1,400 sq ft; gross weight, 34,000 lb; wing loading, 24.3 lb/sq ft; range, 3,000 miles at 125 m.p.h. at 10,000ft with 4,400 lb payload.

CURTISS COMMANDO • The post-war CW-20 Commando is a direct development of the C-46 military transport. It has been bought since the war in large numbers, particularly by U.S. charter firms, who have found it eminently suitable, especially for their freight needs. Scheduled passenger services also are operated in many parts of the world with Commandos, seating accommodation being normally restricted to 40.

CW-20E Commando (two Cyclone 14, total 4,200 h.p.).—Span, 108ft 11in; length, 76ft 4in; wing area, 1,360 sq ft; gross weight, 40,000 lb (U.S.A. regulations) or 45,000 or 50,000 lb; wing loading (at 50,000 lb), 36.8 lb/sq ft; range, 1,600 miles at 220 m.p.h. at 10,000ft with 12,000 lb payload.

DOUGLAS DC-3 (and developments) • Without doubt it is this aircraft which has brought experience of air transport to the greatest number of people in all parts of the globe. Total production of the type exceeded 10,000 (excluding those built in the U.S.S.R. and Japan)—and over a thousand remain in

Douglas DC-3 (Cyprus Airways).

ALVIS

LEONIDES

Chosen by the Royal Air Force, after extensive competitive trials, to power their standard basic trainer
THE PERCIVAL PROVOST

ALVIS LIMITED · COVENTRY · ENGLAND

RANGE... *the long and the short of it*

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WORKS AT: EAST COWES, ISLE OF WIGHT · EASTLEIGH, SOUTHAMPTON · BEAUMARIS, ANGLESEY

Martin 4-0-4 (California Central Airlines).

Convair 240 (Trans-Australia Airlines).

Commercial Aircraft 1953 . . .

scheduled and non-scheduled use. Its operational ubiquity is emphasized, were emphasis needed, by the obvious need which has existed since the end of the war for a "Dakota replacement"—a need regrettably still unfulfilled.

In B.E.A. service, a recent DC-3 conversion has been to the improved *Pionair* standard, which includes modified interior equipment and built-in stairs, and is designed for two-crew (plus steward) operation. This version carries 32 passengers, compared with 21 in the standard machine. Yet another DC-3 "mod" has brought a new form of propulsion to this 20-year-old design, by the fitting of two freight Dakotas with Rolls-Royce Dart turboprops by B.E.A., in order to gain experience useful for Viscount operations.

DC-3 (two Twin Wasp, total, 2,400 h.p.).—Span, 95ft; length, 64ft 6in; wing area, 987 sq ft; gross weight, (C.A.A.) 25,000 lb; wing loading, 25.4 lb/sq ft; range, 1,500 miles at 190 m.p.h. at 8,000ft with 6,500lb payload.

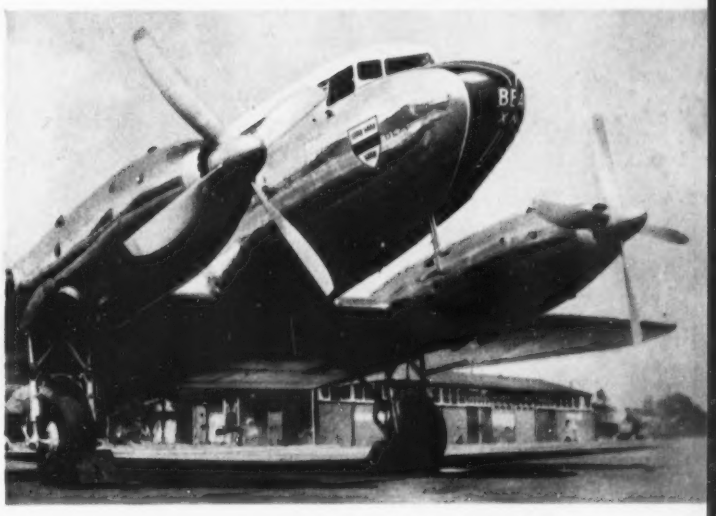
LOCKHEED TWIN SERIES • Consisting of the model 10 Electra, and successive developments—the model 12, model 14 and Lodestar—this well-known series of light/medium transports has found a ready market over the past 18 years, particularly with the smaller companies. There appears no replacement of comparable economy and performance.

Lodestar (two Twin Wasp, Hornet or Wright Cyclone, total 1,500 to 2,400 h.p.).—Span, 65ft 6in; length, 49ft 10in; wing area, 551 sq ft; gross weight, 18,500 lb; wing loading, 33.6 lb/sq ft; range, 1,300 miles at 220 m.p.h. at 10,000ft with 4,500 lb payload.

MARTIN 2-0-2 and 4-0-4 • A pressurized development of the 2-0-2—first post-war transport to be certificated in the U.S.A.—the 4-0-4 is in widespread use, particularly among the North American airlines. The 2-0-2A, a re-engined version of the 2-0-2, is in use with T.W.A., and possesses the higher gross weight of 43,000 lb.

Main difference between 4-0-4 and 2-0-2, apart from the pressurization, is the increased length of the 4-0-4's fuselage. In addition, an hydraulically operated self-contained rear loading ramp is fitted, and an increase in under-seat baggage space of 50 per cent has been obtained. In the medium-range category, the 4-0-4 carries 40 passengers.

Martin 4-0-4 (two Double Wasp, total, 4,800 h.p.).—Span, 93ft 3in; length 74ft 7in; wing area, 864 sq ft; gross weight, 42,750 lb; wing loading, 50.5 lb/sq ft; range, 900 miles at 255 m.p.h. at 18,000ft with 9,500 lb payload.



Dart-Dakota (B.E.A.).

Convair 340.

Lockheed Lodestar (East African Airways)

Commercial Aircraft 1953 . . .

UNDER 12,500 lb

AIRSPEED CONSUL • Last in the Envoy-Oxford line of small feederliners by the late Airspeed company, the Consul remains in use, particularly on charter work, in many countries.

Consul (two Cheetah 10, total 790 h.p.).—Span, 53ft 4in; length, 35ft 4in; gross weight, 8,250 lb; range, 700 miles at 150 m.p.h. at 8,000ft with 1,500 lb payload.

AUSTER AMBULANCE/FREIGHTER • This unique small aircraft is normally fitted to carry seats, stretchers, or light freight in its large cabin, but can alternatively perform crop-spraying, cable-laying and other specialized duties.

Auster model B.4 (Bombardier, total 180 h.p.).—Span, 37ft; length, 24ft 8in; wing area, 190 sq ft; gross weight, 2,600 lb; wing loading, 13.7 lb/sq ft; range, 300 miles at 105 m.p.h. at 5,000ft with 550 lb payload.

Curtiss C-46 Commando

(Below) S.M.95

Ilyushin IL 12 (LOT)

S.N.C.A.S.O. Bretagne

Hurel Dubois H.D. 31

AVRO XIX • A post-war development of the "old faithful" R.A.F. Anson—which, incidentally, was itself developed from the Imperial Airways Avro 652 of 1933—the nine-passenger Mk XIX is in widespread commercial use, together with many ex-service Ansons.

Avro 652A type XIX (two Cheetah, total 840 h.p.).—Span, 56ft 6in; length, 42ft 3in; wing area, 440 sq ft; gross weight, 10,400 lb; wing loading, 22.4 lb/sq ft; range, 610 miles at 155 m.p.h. at 8,000ft with six passengers.

DE HAVILLAND DOVE • Several hundred of these attractive light transports have been sold to operators in many countries, including the U.S.A. From eight to eleven passengers are carried in the standard version, while other variants include survey, ambulance, "flying classroom," and five-passenger executive models. It is remarkable that only after the Dove had been in world-wide use for several years did considerable interest in the type begin to be shown in the United States. Present Dove production is still considerable and a high proportion is going to business houses and private owners in America, where the retail price is some $89,000. Altogether some 500 Doves and Devons (the military version) are likely to be built.

D.H. 104 Dove (two Gipsy Queen 70, total 690 h.p.).—Span, 57ft; length, 39ft 4in; wing area, 335 sq ft; gross weight 8,500 lb; wing loading, 25.36 lb/sq ft; range, 500 miles at 180 m.p.h. at 10,000ft with 1,700 lb payload.

Gloster Javelin

Now in Super Priority Production for the R.A.F.

Gloster Aircraft Co. Ltd. Hucclecote, Glos.

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Control Panel for Gas turbine starters

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This panel automatically controls the whole gas turbine starting cycle, once the starter button is depressed. Protective devices ensure that a second start cannot be made until sufficient time has elapsed to allow for the possibility of delayed cartridge ignition. The panel also protects the turbine starter by preventing it from firing while the engine is rotating faster than the safe starting speed.

For future developments in Turbine Starting — look to **Plessey**

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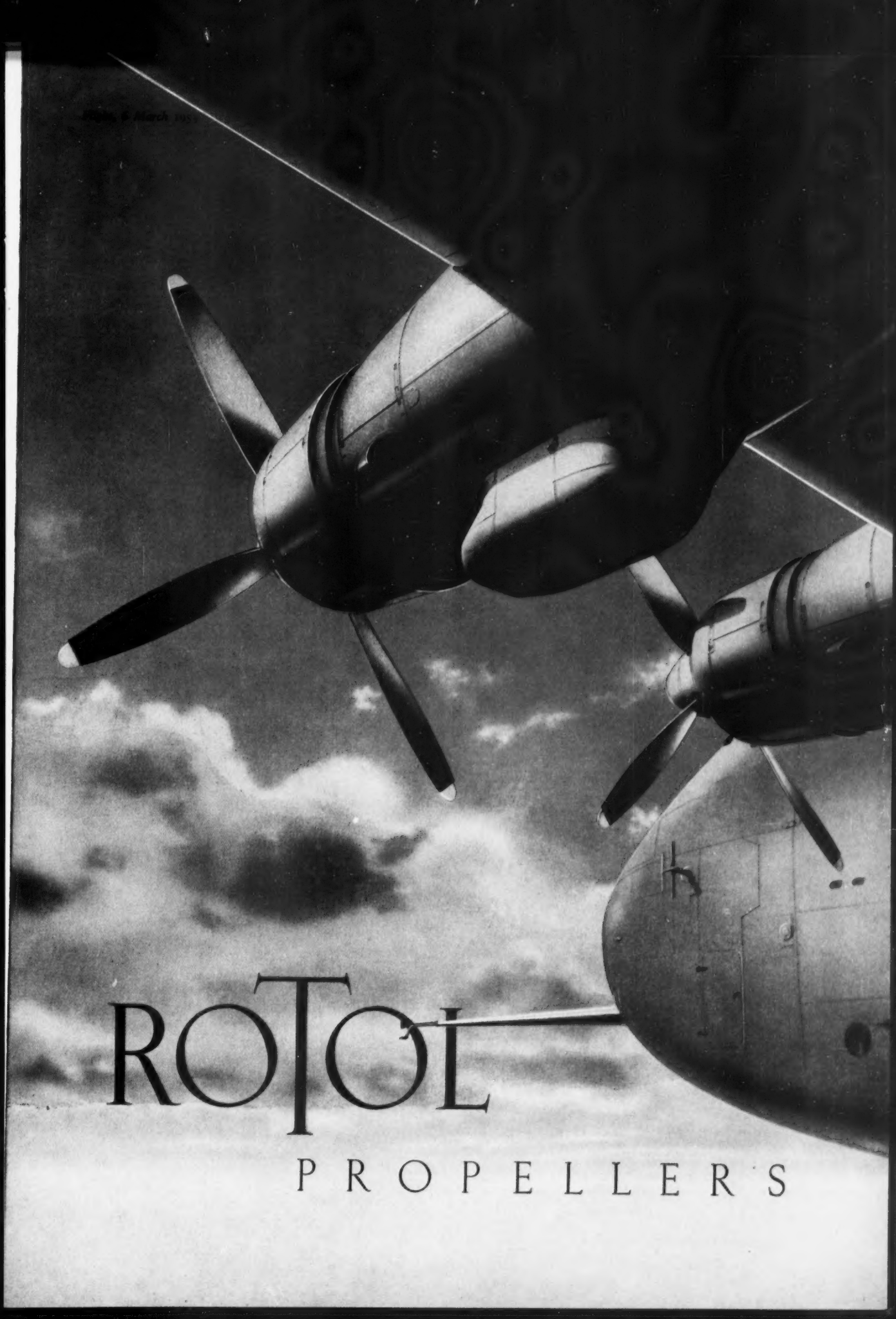
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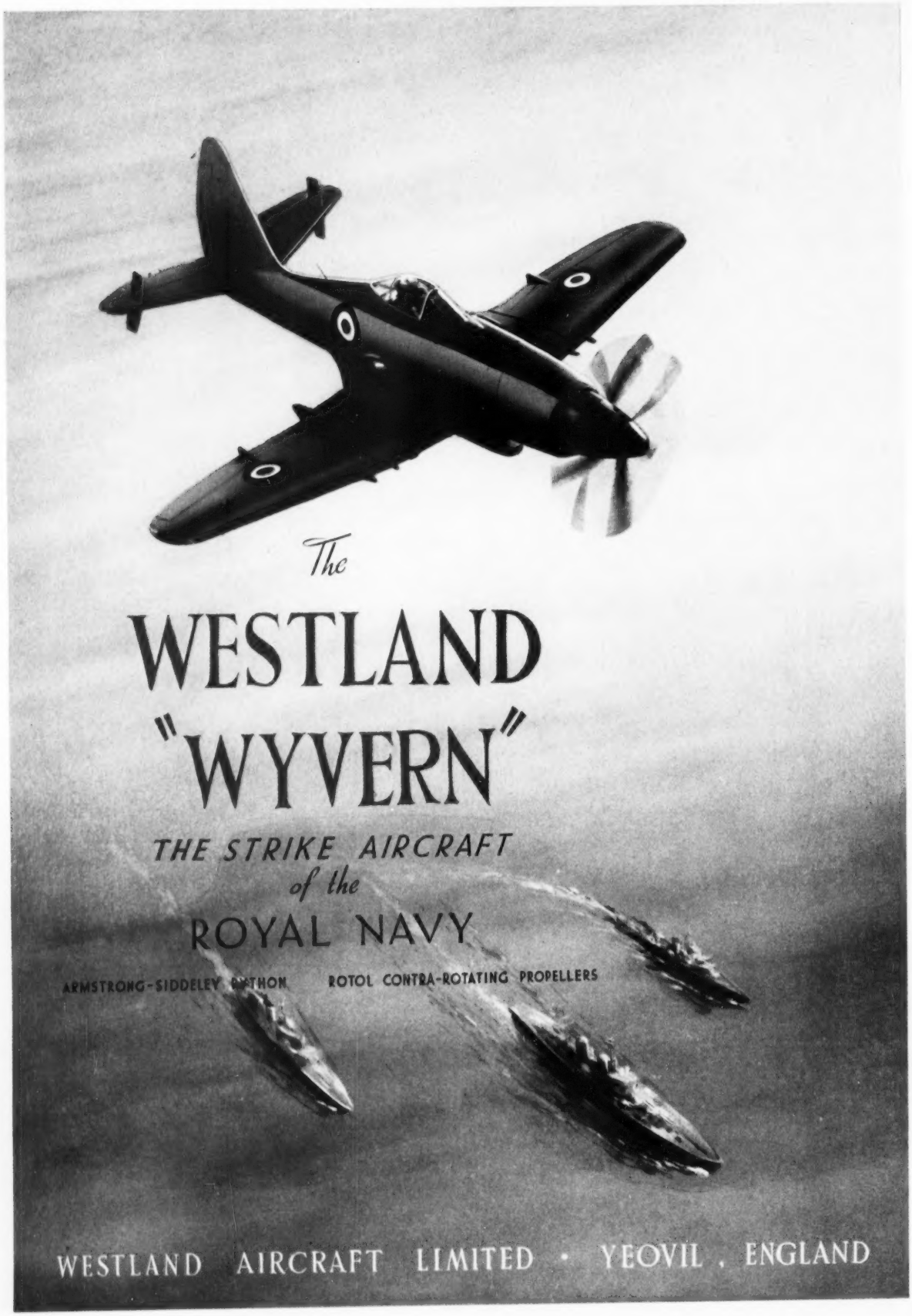
PROPELLERS


The
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THE STRIKE AIRCRAFT
of the
ROYAL NAVY
ARMSTRONG-SIDDELEY PYTHON
ROTOL CONTRA-ROTATING PROPELLERS
WESTLAND AIRCRAFT LIMITED · YEOVIL . ENGLAND

Short Sealand.

De Havilland Dove (Linea Aerea Nacional, Chile).

Commercial Aircraft 1953 . . .

UNDER 12,500 lb.

DE HAVILLAND D.H. 84, 86B AND 89 • This series of versatile biplanes has continued to perform useful "small-field" service since the introduction of the D.H. 84 Dragon in 1933. Many D.H. 89 Dragon Rapides, seating eight, are still active, and the four-engined 86B, now disappearing, has an impressive history of pre-war airline service in all parts of the world.

D.H. 89A (two Gipsy Six, total 400 h.p.).—Span, 48ft; length, 34ft 6in; wing area, 336 sq ft; gross weight, 5,850 lb; wing loading, 17.4 lb/sq ft; range, 450 miles at 120 m.p.h. at 8,000ft with 1,200 lb payload.

PERCIVAL PRINCE • Designed for feederline, charter and freight work, the Prince first flew in May, 1948. It has since been produced in several versions, including the naval Sea Prince for communications and training, the R.A.F. Pembroke and the Survey Prince, in addition to the standard civil eight-passenger Mk III.

Percival P.50 Prince III (two Leonides, total 1,100 h.p.).—Span, 56ft; length, 42ft 10in; wing area, 365 sq ft; gross weight, 11,000 lb; wing loading, 30.1 lb/sq ft; range, 650 miles at 170 m.p.h. at 10,000ft with 1,700 lb payload.

PRESTWICK PIONEER • The incredible slow-flying and landing characteristics of this Scottish Aviation machine, demonstrated well at Farnborough, emphasize its usefulness for operation into and out of restricted spaces. A proposed development is the Twin Pioneer, to be fitted with two Alvis Leonides, which would carry up to 16 passengers.

Scottish Aviation Prestwick Pioneer Mk II (Leonides 501/4, 520 h.p.) —Span, 49ft 9in; length, 34ft 6in; wing area, 411 sq ft; gross weight, 5,400 lb; wing loading, 13.2 lb/sq ft; range, 400 miles at 120 m.p.h. at 5,000ft with 850 lb payload.

SHORT SEALAND • Two versions of the Sealand are available; the Mk I amphibian carrying five to eight passengers, and the ten-seat Mk 3 flying boat, with slightly improved performance. Sealands are operating in Norway, Yugoslavia, India and elsewhere.

Short S.A.6 Sealand I (two Gipsy Queen 70-3, total 680 h.p.).—Span, 61ft 6in; length, 42ft 2in; wing area, 359 sq ft; gross weight, 9,100 lb; wing loading, 25.4 lb/sq ft; range, 522 miles at 127 m.p.h. at 5,000ft with 935 lb payload.

DE HAVILLAND DROVER • Designed and built by the Australian de Havilland company as a Dragon Rapide replacement, the Drover is a three-engined light transport incorporating many of the Dove's structural features, with a simple non-retractable landing gear.

DHA-3 Drover (three Gipsy Major, total 435 h.p.).—Span, 57ft; length, 37ft; wing area, 325 sq ft; gross weight, 6,500 lb; wing loading, 20 lb/sq ft; range 500 miles at 140 m.p.h. at 5,000ft with 1,500 lb payload.

DE HAVILLAND BEAVER • The second post-war design of the de Havilland Aircraft of Canada, Ltd., and a worthy successor to the first, the Chipmunk, is the Beaver, a single-engined high-wing light transport admirably suited to bush flying duties. Seaplane and ski-plane versions are in existence.

DHC-2 Beaver (R-985 Wasp Junior, 450 h.p.).—Span, 48ft; length, 30ft 3in; gross weight, 4,820 lb; range, 480 miles at 140 m.p.h. at 5,000ft with 1,000 lb payload.

DE HAVILLAND OTTER • Following the Beaver came the Otter, an enlarged bush transport with exceptional slow-flying abilities, and accommodation for up to 13 passengers.

DHC-3 Otter (R-1340 Wasp, 600 h.p.).—Span, 58ft; length, 41ft 10in; wing area, 375 sq ft; gross weight, 7,200 lb; wing loading, 19.2 lb/sq ft; range, 500 miles at 150 m.p.h. at 5,000ft with 2,040 lb payload.

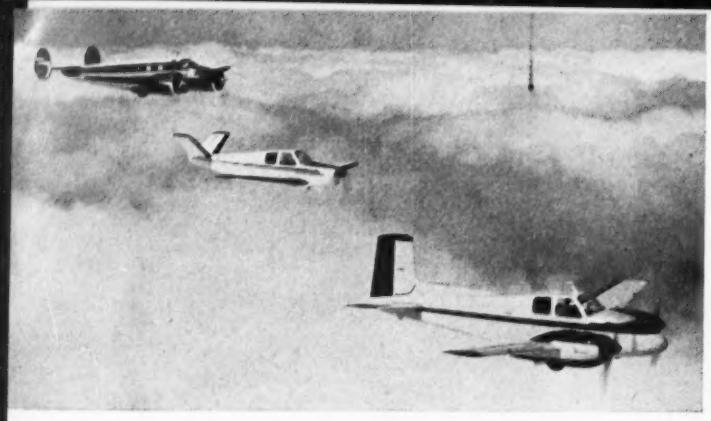
C.C.F. NORSEMAN • No longer in production, this machine was originally designed and made by Noorduyn Aviation, and manufacture was later taken over by the Canadian Car and Foundry Company. In military use during the war, the type is still operated by many small firms in the Canadian "bush" country.

C.C.F. Norseman V (R-1340 Wasp, 600 h.p.).—Span, 51ft 8in; length, 31ft 9in; wing area, 325 sq ft; gross weight, 7,400 lb; wing loading, 22.75 lb/sq ft; range, 400 miles at 130 m.p.h. at 5,000ft with 2,100 lb payload.

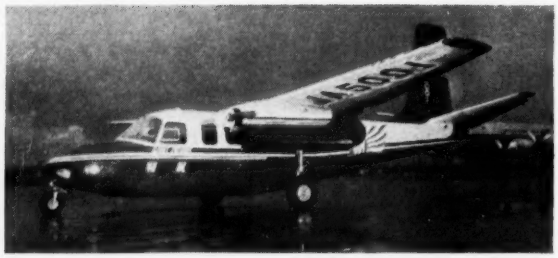
S.N.C.A.S.O. CORSE • In use with various French operators, the S.O.95 Corse is developed from the S.O. 90 prototype designed in France during the war, and accommodates up to 13 passengers.

S.O.95 Corse II (two Renault 125-02-201, total 1,180 h.p.).—Span, 59ft; length, 40ft 5in; wing area, 405 sq ft; gross weight, 12,350 lb; wing loading, 30.5 lb/sq ft; range, 720 miles at 190 m.p.h. at 8,000ft with 1,500 lb payload.

D.H. Drover (Qantas Empire Airways). *Below, Percival Prince (M.C.A.)*



Beech 18, 35 and 50.



Aero Commander (Asahi, Tokyo).

Commercial Aircraft 1953 . . .

MACCHI M.B.320 • Of virtually all-wood construction, this is a six-seat, low-wing monoplane with nosewheel undercarriage. Three are operated by East African Airways and a licence-to-build is held by S.F.C.A. of Paris.

M.B.320 (two Continental E-185, total 370 h.p.).—Span, 42ft 8in; length, 28ft 4in; wing area, 226 sq ft; gross weight, 4,960 lb; wing loading, 22 lb/sq ft; range, 620 miles at 160 m.p.h. at 6,500ft with 1,090 lb payload.

AERO COMMANDER 520 • Of all-metal structure, this light transport is well shown in the illustration at the top of this page. Many varieties are foreseen to cater for a diverse range of duties.

Commander 520 (two Lycoming GO-435-C2, total 520 h.p.).—Span, 44ft 2in; length, 34ft 4in; wing area, 236 sq ft; gross weight, 4,800 lb; wing loading, 20.3 lb/sq ft; range, 800 miles at 190 m.p.h. at 10,000ft with 1,120 lb payload.

BEECH D18 • Under the name of "Twin-Beech" many hundreds of these fine transports are used by American business houses. The type is also used by a number of airlines and is still in full production at Wichita, after 16 years. Thousands of military variants were, and still are being, built.

Beech D18S (two Wasp Junior R-985-B5, total 900 h.p.).—Span, 47ft 7in; length, 34ft; wing area, 349 sq ft; gross weight, 8,750 lb; wing loading, 25 lb/sq ft; range, 970 miles at 210 m.p.h. at 10,000ft with 1,280 lb payload.

BEECH 35 BONANZA • More money has been spent in buying Bonanzas than in the purchase of any other light aircraft. Some thousands have been built. There are four seats, construction is all-metal and equipment is lavish.

Bonanza (one Continental E-185-11, total 205 h.p.).—Span, 32ft 10in; length, 25ft 2in; wing area, 178 sq ft; gross weight, 2,700 lb; wing loading, 15 lb/sq ft; range, 760 miles at 170 m.p.h. at 10,000ft with 822 lb payload.

BEECH 50 TWIN-BONANZA • Already sales of this fast and well-equipped six-seater run into hundreds. Many Bonanza parts are used in its construction. A number of Twin-Bonanzas are being built for the U.S.A.F. and Army, as the L-23.

Twin-Bonanza (two Lycoming GO-435-C2, total 520 h.p.).—Span, 45ft 3¼in; length, 31ft 6¼in; wing area, 271 sq ft; gross weight, 5,500 lb; wing loading, 20.3 lb/sq ft; range, 650 miles at 187 m.p.h. at 10,000ft with 920 lb payload.

Auster Ambulance/Freighter.

Grumman Widgeon. (Dagens Nyheter, Stockholm).

CESSNA 190 • Large numbers of these high-wing, five-seat aircraft are used on "non-sked" and charter services in the United States. Typical operators are Midway Airlines, of the Chicago area, using the more powerful 195A. Many hundreds of these aircraft are privately owned.

Cessna 190 (one Continental R-975, total 240 h.p.).—Span, 36ft 2in; length, 27ft; wing area, 218 sq ft; gross weight, 3,350 lb; wing loading, 15.4 lb/sq ft; range 700 miles at 166 m.p.h. at 7,000ft with 800 lb payload.

GRUMMAN G-44 WIDGEON • Many Grumman amphibians are still doing passenger, freight and charter work in all parts of the world. Shown on this page is a Widgeon belonging to a Swedish newspaper.

G-44 Widgeon (two Ranger L-440-5, total 400 h.p.).—Span, 40ft; length, 31ft 3in; wing area, 245 sq ft; gross weight, 4,500 lb; wing loading, 18.4 lb/sq ft; range, 700 miles at 130 m.p.h. at 5,000ft with 900 lb payload.

D.H. Canada Otter and Beaver.

D.H. 89A Dragon Rapide (N.Z.N.A.C.).

Commercial Aircraft 1953 . . .

HELICOPTERS

(Top) Bristol 173 (for British European Airways.) (Left) Bell 47 (Helicopter Air Service, Chicago). (Above) Hiller 360 (Pest Control, Ltd.).

THE helicopter is slowly but firmly taking its place in the pattern of commercial aviation, on both charter and scheduled work. Listed here are the main machines in present or near-future use; these and other types were described at length in *Flight's* special Helicopter Number of January 23rd.

BELL 47 • Chosen for scheduled mail operation in Belgium, Sweden and the United States, the ubiquitous Bell performs also many other and varied tasks, such as crop spraying, power-line inspection, forestry surveying, and ambulance and rescue duties.

Rotor diameter, 35ft 1½in; gross weight, 2,350 lb; cruising speed, 78 m.p.h. (Franklin 6V4-200-C32 of 200 h.p.)

BRISTOL 171 • The five-seat civil version of Bristol's first rotorplane project is the Mk 3, three of which B.E.A. expect to be operating on the London-Birmingham passenger service later this year. Under development at present is the Mk 4, an interchangeable civil/military version with starboard pilot-position.

Rotor diameter, 48ft 6½in; gross weight, 5,200 lb; cruising speed, 120 m.p.h. (Alvis Leonides 73 of 550 h.p.)

BRISTOL 173 • One of the world's first twin-engined helicopters, this 13-passenger machine impressed onlookers at Farnborough last year with its efficient "airliner" appearance. The first 173 Mk 3 (carrying 17 passengers) will be fitted with Leonides Major engines, and B.E.A. plan to operate a small fleet of these developed versions on inter-city routes after twin-engined experience has been gained with the present type.

Rotor diameter, 48ft 6½in; gross weight, 10,600 lb; cruising speed, 113 m.p.h. (Two Alvis Leonides 73, each of 550 h.p.)

HILLER 360 • Although present production is confined to the military developments of this design, large numbers of the two-seat commercial Hillers are flying in many countries. In Britain, the simplicity and economy of this small rotorplane have established it as the most suitable type for the manifold bucolic duties of Pest Control, Ltd., one of this country's leading helicopter operators.

Rotor diameter, 35ft; gross weight, 2,500 lb; cruising speed, 70 m.p.h. (Franklin 6V4-200-C33 of 200 h.p.)

WESTLAND-SIKORSKY S-51 • In addition to flying on crop-spraying and other charter work, this well-known helicopter has formed the mainstay of B.E.A.'s helicopter researches over the past six years, and was selected for the world's first scheduled passenger helicopter service. It has since been employed on both passenger and mail scheduled services with outstanding regularity.

Rotor diameter, 48ft; gross weight, 5,700 lb; cruising speed, 85 m.p.h. (Alvis Leonides 521 of 520 h.p.)

WESTLAND-SIKORSKY S-55 • With an already notable background of military operations, this machine is coming into increasing civil use. Made by Sikorsky in the U.S., Westlands in England (and soon by S.N.C.A.S.E. in France), the S-55 carries ten passengers plus a two-man crew. Executive transport, freight and mail duties are already performed on a sizeable scale by S-55s in the U.S.A. Ease of maintenance in operation is assisted by the clamshell-type nose-doors.

Rotor diameter, 53ft; gross weight, 6,800 lb; cruising speed, 86 m.p.h. (Pratt and Whitney Wasp R-1340 of 600 h.p.)

Sikorsky S-51 (B.E.A.).

Sikorsky S-55 (Los Angeles Airways).

B.E.A. IN 1952

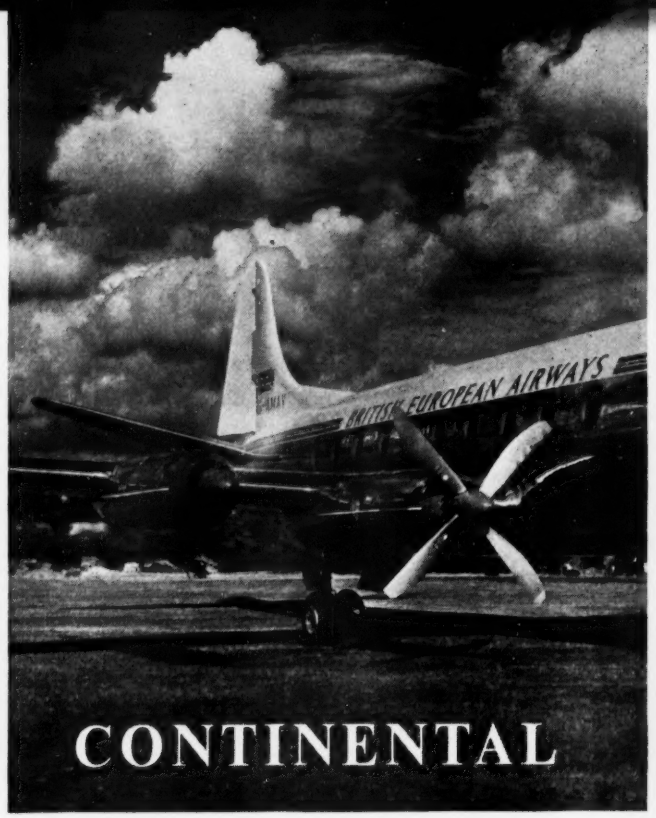
FOR Britain's national short-haul airline, 1952 was a year of notable progress—accomplished in spite of a number of frustrating setbacks. The introduction of larger and more economic aircraft into service accompanied a continuation of B.E.A.'s overall research, development and proving programme on helicopter and turboprop operations.

Disappointing news came early in the year. In January, the foreign currency travel allowance was cut from £50 to £25, and in March the U.K. fuel tax was increased from 1s 10½d to 2s 6d per gallon. On continental and domestic services respectively, these impositions had a drastic effect : an estimated revenue loss during the year of over £900,000 on the former came with an increase in fuel tax paid of £140,000 on the latter.

In March, the long-awaited first scheduled service of the 47-seat Elizabethan was flown, on the London-Paris route : passenger-reaction to the type was enthusiastic. Bad news again in May, with the fuel supply crisis caused by the U.S. oil strike. Almost 2,000 B.E.A. services were cancelled as a direct result, affecting 61,000 passenger seats.

The inevitable future problem of city-centre helicopter operation was tackled in July, with a series of experimental flights to and from the South Bank site, London. Following the initial Viscount 700 proving flights in August, what was without doubt the most significant trend of the year appeared—towards lower fares. Using 38-seat *Admiral*-class Vikings, the London-Paris off-peak service was flown at a return fare reduced by 40 per cent. Twenty per cent reductions on the Scottish internal fares preceded the most effective and profitable step of all : introduction of the £8 weekly return fare from London to either Glasgow or Edinburgh. The consequent traffic increase and improvement in financial position was exceptional. As is well known, tourist fares are about to be extended to the whole of B.E.A.'s continental network during 1953—a heartening trend for travellers.

The prospects for 1953 appear good. With the widespread introduction of the Viscount into scheduled service in the immediate future, B.E.A. will have the most competitive aircraft fleet in service in Europe. One further fact deserves mention, apart from the data below. A main factor in B.E.A.'s progress during 1952, and indeed for several years before that, has been the exceptionally keen and vigorous team spirit within the organization, a spirit undoubtedly attributable in large measure to the leadership and enthusiasm of the chief executive, Mr. Peter Masefield, and to the unstinted support of his staff.



THE CORPORATION'S BACKGROUND

WITH the passing of the Civil Aviation Act, 1946, all British scheduled airline operations became the responsibility of State airline corporations and the British European Airways Corporation was formed on August 1st, 1946, with the maintenance of British Isles services and services to Continental Europe as its allotted task.

At the end of the 1939-45 war, R.A.F. Transport Command had begun to operate essential air services to Europe, but at the beginning of 1946 these were taken over by the European Division of B.O.A.C. until the formation of the second Corporation.

British internal services had been developed by a number of private companies and the essential services had been maintained throughout the war by some of these companies, most of which worked together as the Associated Airways Joint Committee. These operations were continued from August 1st, 1946, under charter to B.E.A., and in February, 1947, B.E.A. took over the routes, aircraft and staff of A.A.J.C. In April that year the operations of Channel Islands Airways and Allied Airways were taken over and B.E.A. became the sole operator.

B.E.A. has developed its system until today it maintains a network of British Isles services and a route system reaching over 30 centres in Continental Europe. The Corporation has interests in one active subsidiary company—Gibraltar Airways—and in six associated operating companies. These are: Aer Lingus, Alitalia, Cyprus Airways, International Aeradio, the Malta Airlines, and S.I.T.A.

In addition to its problems of day-to-day operation, many long-term and basic research and development projects have been studied by the Corporation. In particular, the problems of helicopter operation have been closely examined; much practical experience has been gained, and British European Airways has become the pioneer of scheduled helicopter services in Europe.

B.E.A. FLEET LIST

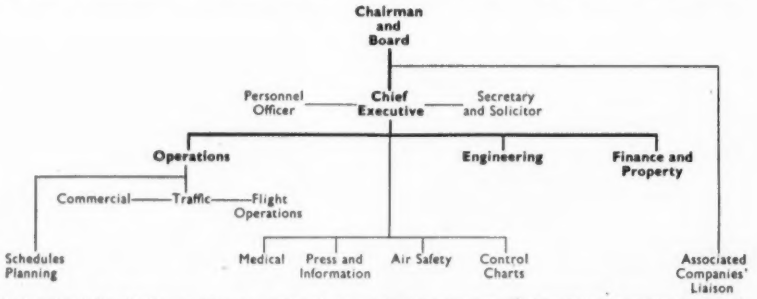
Fixed Wing.—Sixteen Elizabethans, 2 Viscount 701s, 32 Vikings, 16 Admiral-class Vikings, 40 Pionair DC-3s, 8 Dakota Freighters, 1 Dart Dakota, 9 Islanders (D.H.89).
Helicopters.—Three S-51s, 2 Bell 47s, 1 Bristol 171 Mk 3.

Traffic Statistics, 1952

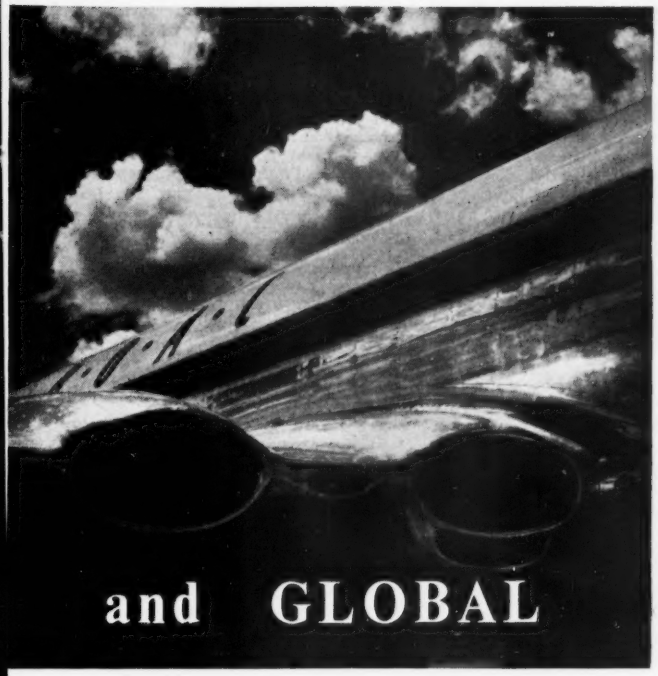
Passengers	1,337,941
Passenger-miles	356,760,085
Freight ton-miles	5,130,132
Mail ton-miles	2,549,987
Ton-miles available	66,576,940
Ton-miles performed	41,896,015
Overall load factor (per cent)	62.9
Aircraft hours flown	168,930
Number of employees	8,454
Unduplicated route mileage	16,585

Financial Statistics, 1952 (Provisional)

	£
Operating revenue	12,690,402
Operating expenditure	13,827,157
Operating loss	1,136,755
Net loss	1,429,645



Under B.E.A.'s chief executive come the three main departments of operations, engineering, and finance and property. This structure, introduced in May, 1952, groups together commercial, traffic and flight operations departments under one controller of operations. ***Members of the Board:*** *Marshal of the Royal Air Force Lord Douglas of Kirtleside, G.C.B., M.C., D.F.C. (chairman): Sir John Keeling (deputy chairman): Peter G. Masefield, M.A., F.R.Ae.S., M.Inst.T. (chief executive): S. K. Davies, C.B.E.: Sir Patrick Dollan, D.L., LL.D., J.P.: W. A. Edmenson, C.B.E.: A. C. Ping, M.Inst.T.A.*

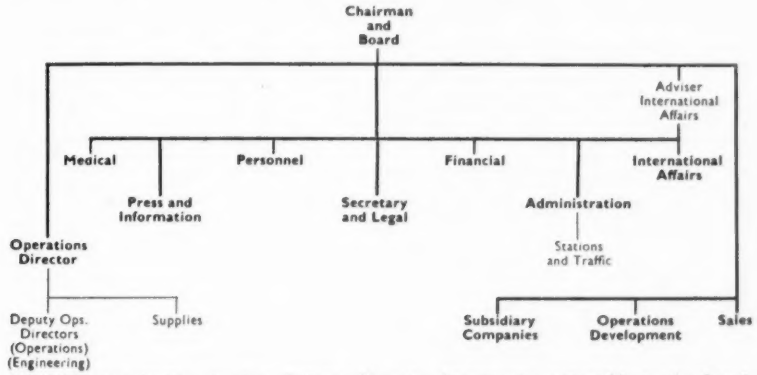


B.O.A.C. IN 1952

THERE is little doubt that credit for the lead at present possessed by this country in the turbojet transport field is due both to the makers of the Comet, the world's first turbojet airliner, and to its first operators. The widespread publicity at present focused on B.O.A.C.'s Comet operations, and so apparently embarrassing to other manufacturers and airlines, is the result of the Corporation's early and bold decision to order Comets off the drawing board, and is entirely deserved. While others talked, B.O.A.C. acted—and arrived first in operation with this new form of propulsion.

The most significant date during the year was undeniably that of May 2nd, when the world's first turbojet airliner service, from London to Johannesburg, was inaugurated. The Comet was subsequently introduced on two other routes during 1952, to Colombo in August and to Singapore in October. The passenger-appeal of these unique services resulted in exceptionally high load factors.

On the North Atlantic routes, too, traffic had increased. The reason here was the introduction of tourist services, to New York and Montreal, using 68-seat Lockheed Constellations: once again, passenger demand was high, resulting in profitable operation.



B.O.A.C.'s organization structure features 11 main departments, responsible to the Board. Departmental heads, with Board chairman and deputy chairman, combine to form the executive management panel. ***Members of the Board:*** *Sir Miles Thomas, D.F.C. (chairman): Whitney W. Straight, C.B.E., M.C., D.F.C. (deputy chairman): J. W. Booth: Major J. R. McCrindle, C.M.G., O.B.E., M.C. (adviser, international affairs): Lord Burghley, K.C.M.G.: Major R. H. Thornton, M.C.: Sir Clement Jones, C.B.: H. L. Newlands, M.B.E.: Sir Francis Brake, M.I.E.E.: Sir John Stephenson, C.B.E., J.P.*

B.O.A.C. FLEET LIST

Eight Comets, 22 Argonauts, 17 Hermes, 6 Yorks, 12 Constellations, 10 Stratocruisers.

B.O.A.C. Scheduled Traffic Statistics, 1952 (Provisional)

Passengers	269,637
Passenger-miles	859,526,721
Freight ton-miles	24,151,988
Mail ton-miles	16,170,796
Ton-miles available	201,554,731
Ton-miles performed	130,637,336
Overall load factor (per cent)	64.8
Aircraft hours flown	137,919
Number of employees	16-17,000
Unduplicated route mileage	89,654

B.O.A.C. Financial Statistics, 1951-52

	£
Operating revenue	33,567,862
Operating expenditure	32,164,801
Operating profit	1,403,061
Profit before interest payment	1,233,722
Net surplus	274,999

Against these promising trends, two main factors caused an unfortunate decrease in revenue. As with B.E.A., the American fuel strike caused many of B.O.A.C.'s peak-travel services to be withdrawn, resulting in an estimated net loss of between £250,000 and £300,000. The second factor was a marked decrease in the volume of mail carried by air—due to causes such as the Australian import restrictions and the political disturbances in the Near East—which is still causing a yearly loss of some £1,250,000.

The first post-war profit to be made by a British airline corporation was announced by B.O.A.C. for its financial year 1951-52. The previous year's net deficit of £4,565,428, after payment of interest, was replaced by an overall surplus of £274,999. In the first six months of the current financial year—up to the end of September, 1952—the Corporation's overall surplus totalled £149,602, or just over half the figure for the 1951-52 year. Because of seasonal traffic fluctuations, however, and the need for summer traffic revenue to cover winter losses before a profit for the year is possible, this April-September figure was nearly £700,000 below expectations, due to the two main causes mentioned above.

For the future, B.O.A.C.'s orders for Comet 2s, Comet 3s and Britannias forecasts a steady improvement in operating performance and economy. There appears no reason for Britain's lead in the operation of turbine-powered civil aircraft to be lost.

THE CORPORATION'S BACKGROUND

THE British Overseas Airways Corporation is responsible for the operation of all the British long-distance scheduled air services, and the Corporation can trace its ancestry back to the beginning of British air transport.

On April 1st, 1924, Imperial Airways was formed, as the national airline, from the four pioneer airlines: Handley Page Transport, Ltd., the Instone Air Line, Ltd., British Marine Air Navigation Co., Ltd., and the Daimler Airway, itself a direct descendant of Aircraft Transport and Travel, Ltd., the company which operated the first British air service from London to Paris, on August 25th, 1919.

The main task of Imperial Airways was the development of trunk air routes linking the United Kingdom with British territories overseas. Routes were surveyed and regular services operated to East and South Africa and to India and Australia. Feeder services were later opened to West Africa and to Hong Kong. The Empire Air Mail Programme was inaugurated in 1937, and in the same year the company began the first experimental airline flights across the North Atlantic.

On April 1st, 1940, Imperial Airways became officially merged with British Airways, which had been flying Continental services and with which I.A.L. had been working since 1939. The new organization was called the British Overseas Airways Corporation, and it began life in the difficult war period, in which it distinguished itself. Since then the Corporation has established itself as one of the world's greatest airlines; its routes now stretch some 90,000 miles to all continents.

Subsidiaries are: Aden Airways, Bahamas Airways, B.W.I.A., Gulf Aviation, British International Airlines and International Aeradio, and there are nine associates.

THE WORLD'S AIRLINES

THIS directory of airlines is based on the latest obtainable information and includes all known operators of regular scheduled passenger and freight services other than the British Corporations (pages 308-9) and independents (pages 314-5).

In order of presentation the facts given are the name by which the airline is usually known, then (if different) the full name; headquarters; routes operated; unduplicated route mileage; fleet; and (where available) traffic ton-miles for passengers, mail and freight for the calendar year 1952. Aircraft used for training and development work have not been included.

An asterisk indicates that the company mentioned is a full member of I.A.T.A. (International Air Transport Association), while a dagger indicates associate membership.

Aden Airways, Aden. (Owned by B.O.A.C.). Routes: Local and to Ethiopia, East Africa, Sudan, Egypt, Saudi Arabia and Syria; mileage 6,000. Fleet: 6 Douglas DC-3s.

Aer Lingus Tta.,* Dublin, Ireland. (Associate of B.E.A.). Routes: Domestic and to the United Kingdom, France and the Netherlands. Fleet: 12 Douglas DC-3s; 4 Bristol 170s. On order, 4 Vickers-Armstrongs Viscount 707s. Traffic ton-miles 7,008,000.

Aero Africaine (Société Africaine des Transports Tropicaux), Algiers, Algeria. All services suspended at time of going to press. Fleet: Douglas DC-3s and Lockheed Lodestars.

Aeroflot (Grazdanskij Wozdusznyj Flot), Moscow, U.S.S.R. (The Soviet national airline.) Routes: Domestic and to Afghanistan, Austria, Bulgaria, China, Czechoslovakia, Finland, E. Germany, Hungary, Iran, Poland and Rumania; mileage 50,000. Fleet: IL 12s, LI 2s (Soviet DC-3s) and smaller aircraft.

Aero Geral, Ltda., Rio de Janeiro, Brazil. Routes: Domestic; mileage 1,345. Fleet: Curtiss C-46s.

Aerolineas Argentinas* (Argentine Airlines), Buenos Aires, Argentina. (The Argentine national airline.) Routes: Domestic and to Chile, Cuba, Europe and the U.S.A.; mileage 35,000. Fleet: 6 Douglas DC-6s, 6 Douglas DC-4s, 20 Douglas DC-3s, 5 Convair 240s and 6 Short Sandringhams.

Aeronaves de Mexico, S.A., Mexico City, Mexico. Routes: Domestic; mileage 2,000. Fleet: Douglas DC-4s and DC-3s. On order, 3 Convair 340s.

Aeronorte (Empresa de Transportes Aéreos Norte do Brasil, Ltda.), São Luiz, Brazil. Routes: In Northern Brazil. Fleet: 4 Percival Princes.

Aero O/Y—See Finnair.

Aero Portuguesa, Ltda.,* Lisbon, Portugal. Routes: Lisbon to Tangier and Casablanca; mileage 1,000. Fleet: Douglas DC-3 and Lockheed Lodestar.

Aerovias Brasil (Empresa de Transportes Aerovias Brasil, S.A.), Rio de Janeiro, Brazil. Routes: Domestic and to Dominican Republic, Trinidad, Miami and Venezuela; mileage 12,000. Fleet: 4 Douglas DC-4s, 21 DC-3s and 6 Curtiss C-46s.

Aerovias Guest, S.A.,* Mexico City, Mexico. Routes: Mexico to Miami; mileage 1,276. Fleet: 2 Douglas DC-4s. Traffic ton-miles 2,771,109.

Aerovias "Q" S.A., Havana, Cuba. Routes: Domestic and to Florida; mileage 500. Fleet: 7 Douglas DC-3s and 2 Curtiss C-46s.

Aerovias Reforma, S.A., Mexico City, Mexico. Routes: Domestic; mileage 3,652. Fleet: 12 Douglas DC-3s.

Aerovias Transcontinentales, S.A. Mexico City, Mexico. Routes: Domestic. Fleet: Douglas DC-3s.

Aigle Azur, Paris, France. Routes: France to Tunis and Morocco, French West Africa, French Equatorial Africa, Madagascar and French Indo-China. Fleet: 5 Boeing Stratoliners and 12 Douglas DC-3s.

Air Algérie,* Algiers, Algeria. Routes: Algiers to France, Majorca and Switzerland; mileage 1,000. Fleet: 1 Breguet Deux-Ponts, 6 S.O. 30P Bretagnes and 5 Douglas DC-3s.

Air Atlas (Compagnie Cherifienne de l'Air), Casablanca, Morocco. Routes: Morocco to Algeria, Spain and France; mileage over 2,000. Fleet: 5 Douglas DC-3s and 2 Languedocs.

Air Ceylon, Ltd.,* Colombo, Ceylon. Routes: Domestic and to India. Ceylon-Europe and Ceylon-Australia operated by Australian National Airways (which has holding in Air Ceylon); mileage 12,500. Fleet: 2 Douglas DC-3s. 2 Douglas DC-4s operated by A.N.A.

Air France* (Compagnie Nationale Air France), Paris, France. Routes: Paris to North, Central and South America, Central Africa, Madagascar, Mauritius, Near East, French Indo-China, Japan and New Caledonia. Local routes in Europe, the Mediterranean area, French Africa, Madagascar and French West Indies; mileage 146,000. Fleet: 23 Lockheed Constellations, 24 Douglas DC-4s, 37 Douglas DC-3s and 15 Languedocs. On order, 3 de Havilland Comet 1As, 10 Lockheed Super-Constellations, 12 Vickers-Armstrongs Viscounts and 12 Breguet Deux-Ponts. Traffic ton-miles 137,957,000.

Air-India International, Ltd., Bombay, India. Routes: Bombay, Delhi and Calcutta to Egypt, Italy, Switzerland, Germany, United Kingdom, Pakistan, Aden and Kenya. Fleet: 4 Lockheed Constellations; 1 Douglas DC-4 of Air-India used on E. Africa tourist services. On order, 2 Lockheed Super Constellations.

Air-India, Ltd., Bombay, India. Routes: Domestic and to Ceylon and Pakistan; mileage 4,220. Fleet: 7 Vickers-Armstrongs Vikings, 11 Douglas DC-3s and 1 Douglas DC-4. Traffic ton-miles 7,300,000.

Air Jordan Co., Amman, Jordan. Routes: To Cyprus, Egypt, the Lebanon, Kuwait, Saudi Arabia and Syria. Fleet: 2 Douglas DC-3s, 1 Curtiss C-46 and 2 Airspeed Consuls.

Air Liban,* Beirut, Lebanon. Routes: Lebanon to Cyprus, Egypt, Iraq, Syria, Turkey, Persian Gulf, Jordan and Saudi Arabia; mileage 4,000. Fleet: 4 Douglas DC-3s and 1 Languedoc.

Airlines (W.A.), Ltd., Perth, Western Australia. Routes: In Western Australia; mileage 4,500. Fleet: 4 de Havilland Doves.

Air Maroc, Paris, France. Routes: Morocco to France, Switzerland and Italy. Fleet: 4 Curtiss C-46s and 6 S.O. 30P Bretagnes. Traffic ton-miles 1,353,000.

Air Services of India, Ltd., Bombay, India. Routes: Domestic; mileage 1,918. Fleet: 8 Douglas DC-3s. Traffic ton-miles 1,342,000

Air Sud, Montpellier, France. Routes: Montpellier to Oran, Algiers and Casablanca; mileage 1,242. Fleet: 3 Lockheed Lodestars.

Air Tahiti, Papeete, Tahiti, Pacific Ocean. Routes: Local. Fleet: Grumman Mallard.

Air Vietnam, Saigon, French Indo-China. Routes: Domestic and to Hong Kong and Thailand; mileage 2,000. Fleet: Douglas DC-3s, Douglas DC-4s and Bristol 170s.

Airways (India), Ltd., Calcutta, India. Routes: Domestic and to Pakistan; mileage 4,251. Fleet: 17 Douglas DC-3s and 2 de Havilland Doves. Traffic ton-miles 9,410,000.

Alaska Airlines, Inc., Anchorage, Alaska. Routes: Domestic and to the U.S.A. Fleet: 4 Douglas DC-3s, 3 Douglas DC-4s, 3 Curtiss C-46s and many small aircraft. Traffic ton-miles 4,968,813.

Alaska Coastal Airlines, Juneau, Alaska. Routes: Local. Fleet: 6 Grumman Goose, 1 Convair Canso. Traffic ton-miles 377,598.

Albury Air Services, Albury, N.S.W., Australia. Routes: Albury-Holbrook-Wagga. Fleet: Not known.

Alitalia (Aerolinee Italiane Internazionali), Rome, Italy. (Associate of B.E.A.). Routes: To Malta, Tripoli, Greece, the Lebanon, Egypt, East Africa, Portugal and South America. Soon to France, Switzerland, Germany and the United Kingdom. Fleet: 4 Douglas DC-4s and 1 Douglas DC-3 (chartered from L.A.I.). On order, 4 Douglas DC-6Bs and 3 Convair 340s.

Allegheny Airlines, Inc., Washington, D.C., U.S.A. Feederline with routes in the Eastern States. Fleet: 12 Douglas DC-3s.

American Airlines, Inc.,* New York City, N.Y., U.S.A. Routes: Domestic and to Canada and Mexico; mileage 10,825. Fleet: 50 Douglas DC-6s, 17 Douglas DC-6Bs, 78 Convair 240s, 13 Douglas DC-4 freighters. On order, 8 Douglas DC-6Bs, 3 DC-6As and 25 DC-7s. Traffic ton-miles (including charter) 358,004,371.

Ansett Airways, Pty., Ltd.,† Melbourne, Victoria, Australia. Routes: Melbourne to Adelaide, Brisbane, Hamilton, Hobart, Sydney and Warrnambool. Fleet: 6 DC-3s.

Arab Airways Association, Ltd., Amman, Jordan. Routes: To Egypt and the Lebanon; mileage 500. Fleet: de Havilland Dragon Rapides and Airspeed Consuls.

Arctic Wings, Ltd., Churchill, Manitoba, Canada. Routes: Regular services in Hudson Bay area and occasional mail services as far north as Arctic Bay. Fleet: 2 Noorduyn Norseman, 1 Avro Anson and 1 Aeronca Champion.

Area - Aerovias Ecuatorianas C.A., Quito, Ecuador. Routes: Domestic and to Miami. Fleet: 2 Boeing Stratoliners, 2 Douglas DC-3s, and 3 Ryan Navions. Traffic ton-miles 1,156,880.

"Arkia" Airlines in Israel, Ltd., Tel Aviv, Israel. (Israel's domestic airline). Routes: Domestic. Fleet: 2 Curtiss C-46s.

Associated Air Lines, Vancouver, B.C. Routes: Local services. Fleet: Not known.

ATSA (Aero Transportes, S.A.), Mexico City, Mexico. Routes: Domestic; mileage 1,849. Fleet: 4 Douglas DC-3s.

Australian National Airways, Pty., Ltd.,† Melbourne, Victoria, Australia. Routes: Extensive network in Australia linking Melbourne, Sydney, Brisbane, Hobart, Adelaide, Perth and other points; mileage 14,449. Fleet: 9 Douglas DC-4s, 28 Douglas DC-3s and 3 Bristol 170s.

Avensa (Aerovias Venezolanas, S.A.), Caracas, Venezuela. (An associate of Pan American World Airways.) Routes: Domestic; mileage 1,500. Fleet: 2 Douglas DC-4s and 19 Douglas DC-3s. On order, 3 Convair 340s.

Aviacion y Comercio, S.A.* (Aviaco), Madrid, Spain. Routes: Domestic and to Tangiers, France, Algeria and the Canary Isles. Fleet: Bristol 170s and Languedocs.

Avianca* (Aerovias Nacionales de Colombia, S.A.), Bogotá, Colombia. (An affiliate of Pan American World Airways, Inc.). Routes: In South America and to Europe and the U.S.A.; mileage 28,844. Fleet: 2 Lockheed Constellations, 8 Douglas DC-4s, 26 Douglas DC-3s, 5 Curtiss C-46s, 1 Convair Canso. On order, 3 Lockheed Super Constellations. Traffic ton-miles 37,800,000.

Aviateca (Empresa Guatemalteca de Aviacion), Guatemala City, Guatemala. Routes: Domestic; mileage 2,000. Fleet: 6 Douglas DC-6s.

Baca Airlines, Jefferson City, Missouri, U.S.A. Routes: Local. Fleet: Beech 18s.

Bahamas Airways, Ltd., Nassau, Bahamas, B.W.I. (Subsidiary of B.O.A.C.) Routes: Inter-Island. Fleet: Convair Cansos and Grumman Goose.

Barrier Reef Airways, Pty., Ltd., Brisbane, Queensland, Australia. See Ansett Airways, Pty., Ltd.

Bharat Airways, Ltd., Calcutta, India. Routes: Domestic and to Burma, Thailand, Singapore and Indonesia. Fleet: Douglas DC-3s and Douglas DC-4s.

Bonanza Airlines, Las Vegas, Nevada, U.S.A. Feederline routes in Nevada, Arizona and California. Fleet: 5 Douglas DC-3s. Traffic ton-miles 1,062,475.

Braathens South-American & Far East Airtransport A.S. (S.A.F.E.), Oslo, Norway. Norwegian independent operator. Routes: Norway to India, Thailand, Hong Kong and Stavanger-Oslo; mileage 18,000. Fleet: 2 Douglas DC-4s, 1 Douglas DC-3 and 2 de Havilland Herons. On order, 2 Super Constellations. Traffic ton-miles 3,960,000.

Braniff International Airways,* Dallas, Texas, U.S.A. Routes: In the north from Minneapolis-St. Paul and Chicago south to Kansas City, St. Louis and other middle U.S. cities, to New Orleans, and Dallas, and Houston and other Texas points. From Memphis in the east to Denver in the west. Also from U.S.A. to Cuba, Panama, Ecuador, Peru, Bolivia, Paraguay, Brazil and the Argentine; mileage 18,942. Fleet: 9 Douglas DC-6s, 8 Douglas DC-4s, 11 Convair 340s, 2 Convair 240s and 32 Douglas DC-3s. On order, 15 Convair 340s.

Bristol Bay Airlines, Bristol Bay, Alaska. Routes: Local. Fleet: Bellanca Skyrocket, Stinson Station Wagon and Stinson Reliant.

British Commonwealth Pacific Airlines, Ltd.,* Sydney, N.S.W., Australia. Routes: Sydney and Aukland to Vancouver via Fiji, Canton Is., Honolulu and San Francisco; mileage 9,749. Fleet: 4 Douglas DC-6s. On order, 3 de Havilland Comet 2s. Traffic ton-miles 7,600,000.

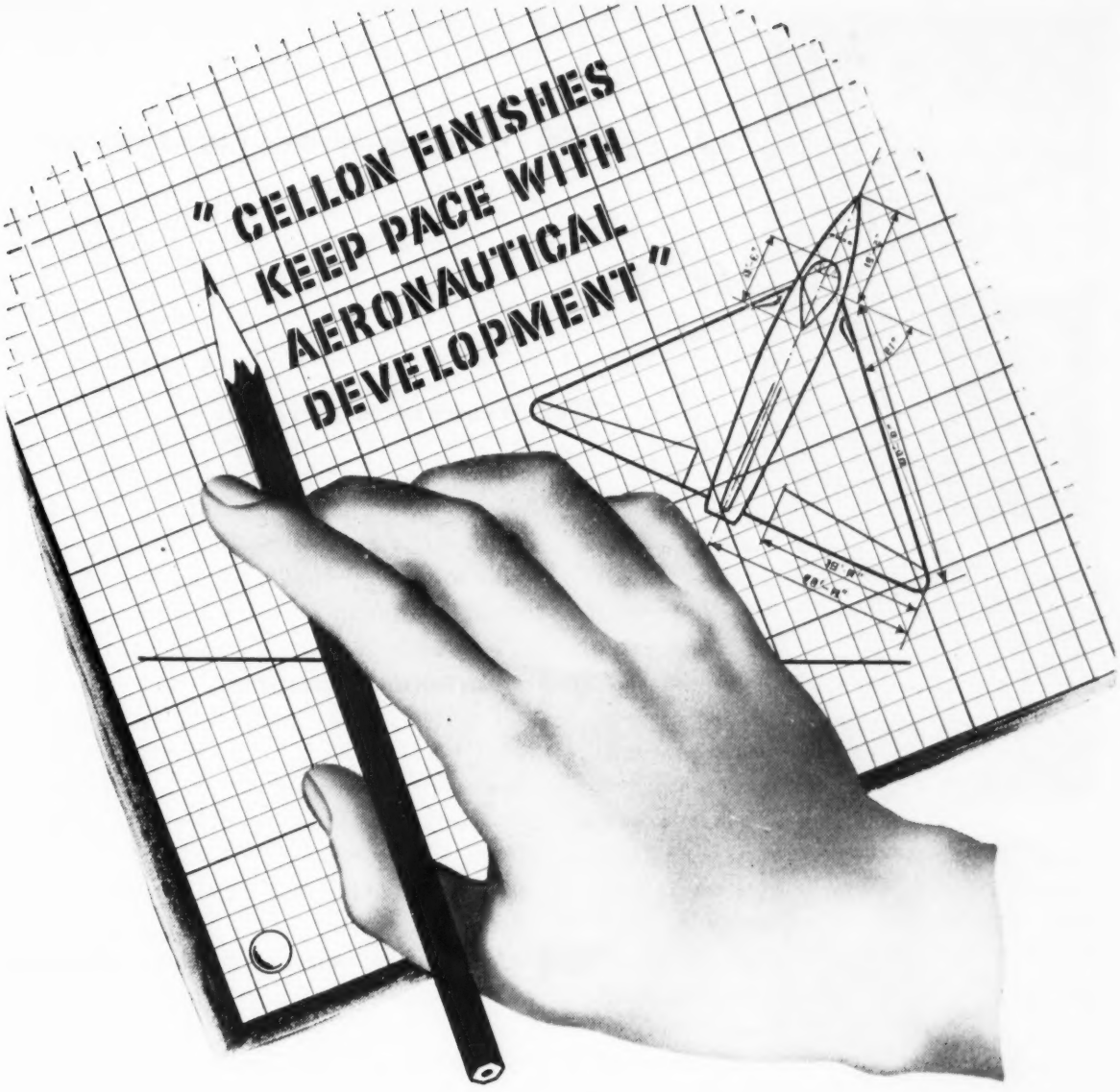
British Guiana Airways, Ltd., Georgetown, British Guiana. Routes: Domestic and to British West Indies. Fleet: Douglas DC-3s and Grumman Goose.

British West Indian Airways, Ltd., Port of Spain, Trinidad, B.W.I. (Owned by B.O.A.C.) Routes in the West Indies. Fleet: Douglas DC-3, Lockheed Lodestar, Vickers-Armstrongs Viking. On order, 3 Vickers-Armstrongs Viscounts.

Butler Air Transport, Pty., Ltd., Sydney, N.S.W., Australia. Routes: Sydney to country districts; mileage 3,000. Fleet: Douglas DC-3s, de Havilland Herons and Avro Ansons.

California Central Airlines, Burbank, California, U.S.A. Scheduled intra-State airline with routes in California. Fleet: 5 Martin 2-0-2s, 1 Lockheed Constellation and 1 DC-3

Canadian Pacific Airlines, Ltd.,* Vancouver, B.C., Canada. Routes: In Eastern and Central Canada, from British Columbia and Alberta to the far north, and trans-Pacific to Tokyo, Auckland and Sydney; mileage over 25,000. Fleet: Douglas DC-6Bs (to total 4), Douglas DC-4s, Douglas DC-3s, and smaller aircraft. Soon to enter service, 2 de Havilland Comet 1As. On order, 5 Convair 340s, 2 Douglas DC-6As.



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The story of B·O·A·C to all six continents

The six advertisements on the left appeared in this magazine during the past eight months. Individually, they tell the story of the development of a specific air route by B.O.A.C. and its predecessors. Collectively, they constitute an accurate, permanent record of British achievements on the air routes of the world.

The story of civil air transport covers little more than thirty years. During that comparatively short time, B.O.A.C. has established regular scheduled services between fifty-one countries on all six continents.

To match the expansion of this world-wide network of air routes, B.O.A.C. airliners have grown in size, speed and comfort. Single engined aircraft have been replaced by twin-engined aircraft, and these in turn by powerful four-engined airliners. Air-conditioning is taken for granted and full pressurization has been perfected. Today all B.O.A.C. airliners fly at fine-weather heights where the air is calm and clear.

B.O.A.C. has earned an enviable reputation for luxury air travel. The superbly comfortable seats, the prompt, courteous attention, the delicious full-course meals—these are but three of the reasons why so many discerning passengers fly B.O.A.C. All meals on First Class services are complimentary — as is the wide choice of mealtime drinks. And *Stratocruiser* passengers may now sleep their way across the Atlantic in the superlative comfort of a foam-soft private berth.

All these improvements, these refinements, are a far cry from the pioneer services that so many of us can still remember. But not content to rest here, B.O.A.C. plans ahead. Plans new routes, new services. Plans to use even faster, more powerful airliners — jetliners. Plans more comfort for the air traveller of today and tomorrow. And all the tomorrows to come.

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THE WORLD'S AIRLINES . . .

Capital Airlines, Inc., Washington, D.C., U.S.A. Routes: Extensive network in Eastern, Southern and Mid-Western States with terminals at New Orleans, Atlanta, Memphis, Minneapolis, Chicago, Soult Ste. Marie, Buffalo, New York, Washington and Norfolk; mileage 5,160. Fleet: 7 Lockheed Constellations, 25 Douglas DC-4s and 25 Douglas DC-3s. Traffic ton-miles 69,338,107.

Caribair (Caribbean Atlantic Airlines, Inc.), San Juan, Puerto Rico. Routes: Domestic and to Dominican Republic and Virgin Islands; mileage 390. Fleet: 3 Douglas DC-3s.

Caribbean International Airways, Ltd., Nassau, Bahamas, B.W.I. Routes: Kingston to Grand Cayman and Tampa. Fleet: Catalinas.

Caspar Air Charters and Agencies, Ltd., Entebbe, Uganda. (In association with East African Airways.) Routes: Local. Fleet: D.H. Rapides.

CAT (Civil Air Transport), Taipeh, Taiwan, Formosa. Routes: Domestic and to Manila, Thailand, Hong Kong, Okinawa, Tokyo, and Korea. Fleet: Douglas DC-4s, Douglas DC-3s and Curtiss C-46s (Skylarks).

Cathay Pacific Airways, Ltd., Hong Kong. Routes: Hong Kong to Borneo, Indo-China, Malaya, Philippine Islands and Thailand. Fleet: 2 Douglas DC-3s and 1 DC-4.

CAUSA (Compania Aeronautica Uruguaya, S.A.), Montevideo, Uruguay. Route: Montevideo to Buenos Aires; mileage 142. Fleet: Short Sandringhams.

Central Aérea, Ltda., Rio de Janeiro, Brazil. See Consórcio Nacional de Transportes Aéreos.

Central African Airways Corporation,* Salisbury, Southern Rhodesia. Routes: In Central Africa and to South Africa; mileage 7,000. Fleet: 9 Vickers-Armstrongs Vikings and 5 de Havilland Beavers.

Central Airlines, Inc., Fort Worth, Texas, U.S.A. Feederline routes in Central Southern States. Fleet: 6 Douglas DC-3s.

Central Air Transport Corporation (CATC), China. No information available.

Central Northern Airways, Ltd., Winnipeg, Manitoba, Canada. Routes: Local. Fleet: Lockheed, Waco, Cessna, Avro Anson, Noorduyn Norseman, de Havilland Beaver, Stinson and Bellanca aircraft.

Chicago and Southern Air Lines, Inc.,* Memphis, Tennessee, U.S.A. Routes: Serving 22 U.S. cities and 11 States. Also to Cuba, Jamaica, Venezuela, Haiti, Dominican Republic and Puerto Rico; mileage 5,854. Fleet: 6 Lockheed Constellations, 12 Douglas DC-3s and 10 Convair 340s in course of delivery.

China National Aviation Corporation (CNAC), China. No information available.

Cie. Air Transport, Paris, France. Routes: Paris to Algiers, Oran and Tunis. Marseilles to Algiers and Oran. Lyon to Algiers. Fleet: 3 Douglas DC-4s.

CMA (Compañia Mexicana de Aviación, S.A.), Mexico City, Mexico. (Affiliate of Pan American World ways, Inc.). Routes: Domestic and to California and Cuba; mileage 4,926. Fleet: 2 Douglas DC-6s, 6 Douglas DC-4s and 19 Douglas DC-3s. On order, 8 Convair 340s.

Colonial Airlines, Inc., New York City, N.Y., U.S.A. Routes: In the Eastern States and to Bermuda and Canada; mileage 2,000. Fleet: 4 Douglas DC-4s and 8 DC-3s.

Commercial Air Services (Pty.), Ltd., Johannesburg, Transvaal, South Africa. Routes: Local. Fleet: de Havilland Dove and Cessna 170.

Compañia Cubana de Aviación, S.A.,* Havana, Cuba. Routes: Domestic and to Miami, Bermuda, Portugal and Spain; mileage 6,914. Fleet: 2 Douglas DC-4s and 6 Douglas DC-3s. Traffic ton-miles 7,543,456.

Compania de Aviacion Faucett, S.A., Lima, Peru. Routes: Domestic. Fleet: 6 Douglas DC-3s, 4 Douglas DC-4s and Faucett-Stinson monoplanes.

Compania Dominicana de Aviacion, S.A., Cuidad Trujillo, Dominican Republic. Routes: Domestic and to Puerto Rico and Florida; mileage 350. Fleet: 2 Douglas DC-3s and 4 Curtiss C-46s.

Connellan Airways, Ltd., Alice Springs, Northern Territory, Australia. Routes: Local. Fleet: D.H. Rapides and Dragonfly.

Consorcio Nacional de Transportes Aéreos, Rio de Janeiro, Brazil. Consists of Central Aérea, Ltda., Organisação Mineira de Transportes Aéreos (OMTA), Transportes Aéreos Nacional, Ltda., and Viação Aérea Brasil, S.A. Routes: Domestic. Fleet: Douglas DC-3s.

Continental Air Lines, Inc., Denver, Colorado, U.S.A. Routes: In Denver, New Mexico, Texas, Oklahoma and Kansas; mileage 2,500. Fleet: 5 Convair 240s, 10 Douglas DC-3s and 2 Douglas DC-6s. On order, 7 Convair 340s.

COPA (Compania Panamena de Aviacion, S.A.), Panama City, Panama. (Associate of Pan American World Airways.) Routes: Local; mileage 354. Fleet: 2 Douglas DC-3s.

Cordova Airlines, Inc., Anchorage, Alaska. Routes: Local. Fleet: Douglas DC-3, Grumman Goose, Cessna 170s, Stinsons and Pipers. Traffic ton-miles 84,629.

Corps d'Aviation de l'Armee Haiti, Port au Prince, Haiti. Routes: Local; mileage 594. Fleet: 3 Douglas DC-3s and Beech 18s.

Cosara (Société des Transports Aériens de l'Extrême Orient), Saigon, French Indo-China. Routes: Local; mileage 2,000. Fleet: Douglas DC-3s and possibly S.O. 30P Bretagne.

ČSA (Československé Aerolinie, n.p.),* Prague, Czechoslovakia. Routes: Domestic and to Austria, Bulgaria, Denmark, Finland, Germany, Hungary, Poland and Roumania. Fleet: IL 12s and Douglas DC-3s.

Cyprus Airways, Ltd.,* Nicosia, Cyprus. (An associate of B.E.A. and B.O.A.C.) Routes: To Egypt, Greece, Israel, Italy, the Lebanon, Persian Gulf, Sudan and Turkey; mileage 7,000. Fleet: 6 Douglas DC-3s.

Deccan Airways, Ltd., Hyderabad State (Deccan), India. Routes: Domestic; mileage 3,596. Fleet: 11 Douglas DC-3s.

Delta Air Lines, Inc., Atlanta, Georgia, U.S.A. Routes: To Chicago, Miami, New Orleans, Fort Worth, etc.; mileage 3,000. Fleet: 7 Douglas DC-6s, 5 Douglas DC-4s and 20 Douglas DC-3s. On order, 4 Douglas DC-7s and 10 Convair 340s in course of delivery. This company is to merge with Chicago and Southern Air Lines.

DETA* (Divisão de Exploracão des Transportes Aéreos), Lourenço Marques, Mozambique. Routes: Domestic and to South Africa and Southern Rhodesia; mileage 2,000. Fleet: 3 Douglas DC-3s, 6 de Havilland Doves, 5 de Havilland Dragon Rapides, 3 Lockheed Lodestars, and 1 Junkers-Ju 52/3m.

DHY (Devlet Hava Yollari), Ankara, Turkey. (Turkish State Air Lines.) Routes: Domestic and to Cyprus, Egypt and the Lebanon; mileage 2,500. Fleet: About 30 DC-3s.

D.T.A.* (Divisão dos Transportes Aéreos), Luanda, Angola, Portuguese West Africa. Routes: Local and to Leopoldville and Pointe Noire; mileage 3,474. Fleet: 5 Douglas DC-3s, 5 Beech 18s and 7 D.H. Rapides. Traffic ton-miles 505,500,000.

East African Airways Corporation,* Nairobi, Kenya Colony. Routes: In East Africa and to South Africa; mileage 19,729. Fleet: 9 Douglas DC-3s, 3 Macchi MB 320s, 2 Lockheed Lodestars and 2 de Havilland Dragon Rapides. Traffic ton-miles 1,869,222.

Eastern Air Lines, Inc.,† New York City, N.Y., U.S.A. Routes: Extensive network in the Eastern and Southern States and to Puerto Rico and Mexico; mileage 7,000. Fleet: 14 Lockheed Super Constellations, 20 Lockheed Constellations, 57 Martin 4-0-4s, 11 Douglas DC-4s. On order, L-1049C Super Constellations.

East-West Airlines, Ltd., Tamworth, N.S.W., Australia. Routes: Local; mileage 1,042. Fleet: 3 Lockheed Hudsons.

El Al* (Israel Airlines, Ltd.), Tel Aviv, Israel. Routes: Israel to London and other European cities, to the U.S.A., East and South Africa. Fleet: 3 Lockheed Constellations, 1 Douglas DC-4 and 2 Curtiss C-46s.

Ellis Air Lines,* Ketchikan, Alaska. Routes: Domestic and to Prince Rupert, B.C.; mileage 459. Fleet: 6 Grumman Goose. Traffic ton-miles 276,665.

Ethiopian Air Lines, Inc., Addis Ababa, Ethiopia. Routes: Domestic and to Aden, Djibouti, Egypt, Kenya and Saudi Arabia; mileage 12,000. Fleet: 2 Convair 240s and 7 DC-3s.

Federation Air Service, Kuala Lumpur, Malaya. Routes: Local. Fleet: de Havilland Beavers.

Fiji Airways, Suva, Fiji. Routes: Local Fleet: 3 D.H. Rapides.

Finnair* (Finnish Air Lines), Helsinki, Finland. (The Finnish national airline.) Routes: Domestic and to Denmark, Germany and Sweden; mileage 3,000. Fleet: 8 Douglas DC-3s. On order, 3 Convair 340s.

Flugfelag Islands, H.F. (Iceland Airways),* Reykjavik, Iceland. Routes: Domestic and to the United Kingdom and Denmark. Fleet: 1 Douglas DC-4, 3 DC-3s, 1 Convair Catalina, 2 Cansos, 1 Grumman Gray Goose, 1 D.H. Dragon Rapide and 1 Noorduyn Norseman.

Frontier Airlines, Inc., Denver, Colorado, U.S.A. Feederline routes in Colorado, Montana, Arizona, New Mexico, Utah and Wyoming. Fleet: 12 Douglas DC-3s.

Garuda Indonesian Airways N.V.,* Diakarta, United States of Indonesia. (The Indonesian national airline.) Routes: In Indonesia and to Manila and Singapore; mileage 15,399. Fleet: 8 Convair 240s, 21 Douglas DC-3s and 6 Convair Cansos. On order, 14 de Havilland Herons and 8 Convair 340s. Traffic ton-miles 13,100,000.

Gibbes Sepik Airways, Ltd., Wewak, New Guinea and Port Moresby, Papua. Routes: Services in Papua, New Guinea and Dutch New Guinea. Fleet: 7 Noorduyn Norseman and 2 Austers.

Gibraltar Airways, Ltd., Gibraltar (subsidiary of B.E.A.). Route: Gibraltar to Tangier. Fleet: Rapides.

Guinea Airways, Ltd., Adelaide, South Australia. Routes: Within South Australia and to N.S.W. and Victoria; mileage 1,656. Fleet: 3 Douglas DC-3s.

Gulf Aviation Co., Ltd., Bahrain, Persian Gulf. (Associate of B.O.A.C.). Routes: Bahrain to Dhahran, Doha and Shariah. Fleet: 4 de Havilland Doves. Traffic ton-miles 59,400.

Hamiata (Sino-Soviet Aviation Corporation), Alma Ata, U.S.S.R. Routes: Alma Ata to Hami; mileage 500. Fleet: Li 2s.

Hawaiian Airlines, Ltd., Honolulu, Hawaii. Routes: Inter-Island. Fleet: 13 Douglas DC-3s and 2 Convair 340s. On order, 4 Convair 340s. Traffic ton-miles 5,188,580.

Helicopter Air Service, Inc., Chicago, Illinois, U.S.A. Short-haul mail operator. Routes: Mail services in Chicago area. Fleet: 6 Bell 47s.

Himalayan Aviation, Ltd., Calcutta, India. Routes: Domestic and to Pakistan, Afghanistan and Iran; mileage 2,000. Fleet: 3 Douglas DC-3s.

Hong Kong Airways, Ltd., Hong Kong. (Owned by Jardine, Matheson and Co., Ltd.). Route: Hong Kong to Formosa. Fleet: 1 Douglas DC-4. Traffic ton-miles 460,000.

Iberia (Lineas Aereas Espanolas),* Madrid, Spain (Spanish national airline). Routes: Domestic and to France, United Kingdom, Italy, Switzerland, West Africa, South America and Cuba; mileage 20,000. Fleet: 6 Douglas DC-4s, 13 DC-3s, 4 Bristol 170s, Junkers Ju 52/3ms, Airspeed Consuls and D.H. Dragon Rapides; 3 Lockheed Super Constellations on order.

Indian National Airways, Ltd., New Delhi, India. Routes: Domestic and to Burma, Nepal and Pakistan; mileage 3,000. Fleet: 6 Vickers-Armstrongs Vikings and 7 DC-3s.

Iranian Airways Company, Teheran, Iran. Routes: Domestic and to Persian Gulf, Pakistan and India. Fleet: 4 Douglas DC-3s, 3 de Havilland Doves and 2 Fairchild Argus.

Iraqi Airways,* Baghdad, Iraq. (Associated with B.O.A.C.). Routes: Within the Middle East to Egypt, the Lebanon, Syria, Kuwait and Bahrain. Fleet: 3 Vickers-Armstrongs Vikings and 1 de Havilland Dove. Traffic ton-miles 1,045,000.

Island Air Service, Port Clinton, Ohio, U.S.A. Routes: Local to islands in Lake Erie. Fleet: 4 Ford Tri-motors.

Japan Air Lines Co., Ltd., Tokyo, Japan. Routes: Domestic. Fleet: 6 Douglas DC-4s. On order, 2 de Havilland Comet 2s, DC-6Bs and 3 de Havilland Herons. Traffic ton-miles 3,540,000.

Jugoslovenski Aero Transport (JAT),* Belgrade, Yugoslavia (the Yugoslav national airline). Routes: Domestic and to Austria, France, Germany, Greece and Switzerland; mileage 3,700. Fleet: Douglas DC-3s and 2 Short Sealands. On order: Convair 240s.

Kalinga Air Lines, Calcutta, India. Routes: Domestic; mileage 197. Fleet: 7 Douglas DC-3s, 1 Convair Catalina and 1 Stinson L-5.

Karhumaki Airways (Velickset Karhumäki), Kuorevesi, Finland. Routes: Domestic and to Sweden. Fleet: Lockheed Lodestars.

K.L.M. (Koninklijke Luchtvaart Maatschappij N.V.—Royal Dutch Airlines), The Hague, Netherlands. Routes: European, West Indies and New Guinea networks and Amsterdam to New York, Montreal, Curaçao, Mexico, Dakar, Rio de Janeiro, Buenos Aires, Santiago de Chile, Johannesburg, Djakarta, Tokyo and Sydney; mileage 113,500. Fleet: 7 Douglas DC-6Bs, 6 Douglas DC-6s, 15 Lockheed Constellations, 12 Convair 240s, 10 Douglas DC-4s, 20 Douglas DC-3s, 1 de Havilland Dragon Rapide and 1 Auster 5. On order, 13 Lockheed Super Constellations, 6 Convair 340s and 2 Douglas DC-6As. Traffic ton-miles 106,800,600.

Korean National Airlines, Pusan, Korea. Routes: Domestic. Fleet: Douglas DC-3s.

LACSA (Lineas Aereas Costarricenses S.A.), San Jose, Costa Rica. (Subsidiary of Pan American World Airways.) Routes: Domestic and to Panama, Nicaragua, Cuba and the U.S.A. Fleet: 4 Douglas DC-3s and 4 Curtiss C-46s. Traffic ton-miles 3,080,000.

LADE (Lineas Aereas del Estado), Buenos Aires, Argentina. Routes: Domestic; mileage 2,000. Fleet: Vickers-Armstrongs Vikings and Douglas DC-3s.

LAI (Linee Aeree Italiane, S.p.A.), Rome, Italy. Routes: Domestic and to France, Trieste, Spain, Greece, Turkey, Israel, Egypt, Tunis and New York. Fleet: 2 DC-6s and DC-3s.

Lake Central Airlines, Indianapolis, Indiana, U.S.A. Routes: Local. Fleet: Douglas DC-3s.

LAMSA (Lineas Aereas Mexicanas, S.A.), Mexico City, Mexico (in association with United Air Lines). Routes: Domestic; mileage 1,500. Fleet: 5 Douglas DC-3s.

LAN (Linea Aerea Nacional, Chile),* Santiago, Chile. Routes: Domestic and to the Argentine and Urusuay. Fleet: Martin 2-0-2s, Douglas DC-3s, Lockheed Lodestars, Electras and D.H. Dragon Rapides.

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La Nica (Lineas Aereas de Nicaragua, S.A.), Managua, Nicaragua. (An associate of Pan American World Airways.) Routes: Local; mileage 1,000. Fleet: Douglas DC-3s. Traffic ton-miles 1,698,414.

LANSA (Lineas Aéreas Nacionales Consolidadas, S.A.), Barranquilla, Colombia. (Avianca affiliate.) Routes: Domestic. Fleet: 16 Douglas DC-3s. Traffic ton-miles 7,560,000.

LAV* (Linea Aeropostal Venezolana), Caracas, Venezuela. Routes: Domestic and to Cuba, Peru, the U.S.A., Curaçao, Barbados and Trinidad. Fleet: 4 Lockheed Constellations, 2 Martin 2-0-2s and 20 Douglas DC-3s.

Leavens Bros. Air Services, Ltd., Toronto, Canada. Routes: Leamington to Pelee Island. Fleet: 2 Cessna Cranes.

Liberian National Airways, Robertsfield, Liberia. Routes: Local. Fleet: Douglas DC-3s and de Havilland Dragon Rapides.

Linea Aerea Taca de Venezuela, Caracas, Venezuela. Routes: Domestic and to Colombia. Fleet: DC-3s.

Loftleidir h.f. (The Icelandic Airlines), Reykjavik, Iceland. Routes: Domestic and to Scandinavia, Germany and the U.S.A. Fleet: Douglas DC-4, Douglas DC-3, Convair Canso, Avro Anson V and Grumman Goose.

Loide Aereo Nacional S/A, Rio de Janeiro, Brazil; mileage 6,000. Routes: Domestic. Fleet: Curtiss C-46s and Douglas DC-3s.

Los Angeles Airways, Inc., Los Angeles, California, U.S.A. Routes: Helicopter mail services in Los Angeles area. Fleet: 3 Sikorsky S-51s and 3 Sikorsky S-55s.

LOT (Polskie Linie Lotnicze),* Warsaw, Poland (the Polish national airline). Routes: Domestic and to Belgium, Czechoslovakia, Denmark, France, Germany, Hungary, Roumania, and Sweden; mileage 4,500. Fleet: About 30 Douglas DC-3s, 12 IL 12s.

MacRobertson - Miller Aviation Co., Pty., Ltd., Perth, Western Australia. Routes: In Western Australia and to Northern Territory; mileage 5,000. Fleet: 3 Douglas DC-3s, 1 Lockheed Electra and 5 Avro Ansons.

Malayan Airways, Ltd.,* Singapore, Malaya. (Associate of B.O.A.C.). Routes: Domestic and to Indonesia, Thailand, French Indo-China and other points. Fleet: 11 Douglas DC-3s and 2 de Havilland Dragon Rapides. Traffic ton-miles 4,100,000.

Malta Airlines, The, Valetta, Malta. Routes: To Benghazi, Cairo, Catania, Rome and Tripoli. Fleet: Vickers-Armstrongs Vikings owned and operated by B.E.A.

Mandated Airlines, Ltd., Lae, New Guinea. Routes: Local. Fleet: Douglas DC-3s, de Havilland Dragon Rapides and Doves.

Maritime Central Airways, Charlottetown, Prince Edward Island, Canada. Routes: Services in the Maritimes. Fleet: 4 Douglas DC-3s, 1 Curtiss C-46 and 1 Convair Canso.

Maszovlet (Magyar-Szovjet Polgari Legiforgalmi), Budapest, Hungary (the Hungarian-Soviet airline). Routes: Domestic and to Czechoslovakia and Roumania; mileage 2,000. Fleet: 10 LI 2s (Soviet DC-3s).

Mid-Continent Airlines, Inc.—became part of Braniff International Airways, August 16th, 1952.

Midway Airlines, Chicago, Ill., U.S.A. Routes: Metropolitan air taxi service from Chicago Airport to downtown Chicago and Northbrook suburb. Fleet: 2 Cessna 195s.

Middle East Airlines Co., Beirut, Lebanon. Routes: To Syria, Egypt, Iraq, Arabia, Jordan, Kuweit, Bahrein, Qatar and Cyprus. Fleet: 7 Douglas DC-3s. Traffic ton-miles 3,075,102.

Misrair S.A.E.,* Cairo, Egypt. Routes: Domestic and to Aden, Eritrea, France, Greece, Iran, Iraq, Italy, Jerusalem, Kuwait, the Lebanon, Saudi Arabia, Sudan, Switzerland, Syria and Turkey; mileage 11,822. Fleet: 4 Languedocs, 7 Vickers-Armstrongs Vikings, 1 Beech 18, 1 Beech Bonanza and 1 Miles Gemini. Traffic ton-miles 2,780,000.

Mont-Laurier Aviation Co., Ltd., Roberval, Quebec, Canada. Route: Roberval to Dore Lake. Fleet: Convair Cansos, Noorduyn Norseman and D.H. Fox Moth.

Mohawk Airlines Inc., Ithaca, N.Y., U.S.A. (late Robinson Airlines). Routes: Local in New York State. Fleet: 10 Douglas DC-3s. Traffic ton-miles 1,875,060.

National Airlines, Inc.,* Miami, Florida, U.S.A. Routes: New York and Washington to Jacksonville, Tampa, Miami and Havana, and New Orleans to Jacksonville, Tampa and Miami; mileage 2,300. Fleet: 7 Douglas DC-6s, 6 DC-4s and Lockheed Lodestars. On order: 14 Convair 340s, 8 Douglas DC-6Bs and 4 Douglas DC-7s.

New York Airways, Inc., New York, N.Y., U.S.A. Routes: Helicopter mail and cargo services Newark to La Guardia and New York International Airport, and between La Guardia and Bridgeport. Fleet: 3 Sikorsky S-55s. To be ordered, 4 Sikorsky S-55s.

New Zealand National Airways Corporation,* Wellington, New Zealand. Routes: Domestic and to Norfolk Island. Fleet: 22 Douglas DC-3s, 4 de Havilland Herons (in course of delivery), 6 D.H. Rapides and 3 Moths.

North Central Airlines, Inc., Minneapolis, Minnesota, U.S.A. Routes: Between Chicago and Hibbing. Fleet: Douglas DC-3s.

Northeast Airlines, Inc., Boston Mass., U.S.A. Routes: Serves New York, Montreal, and New England. Fleet: 4 Convair 240s and 9 Douglas DC-3s. Traffic ton-miles 8,233,657.

Northern Consolidated Airlines, Anchorage, Alaska. Routes: Local; mileage 2,000. Fleet: Includes Douglas DC-3s.

Northern Wings, Ltd., Seven Islands, Quebec, Canada. Routes: Local. Fleet: Noorduyn Norseman, Beech, Avro Ansons, and Convair Cansos.

Northwest Airlines, Inc., St. Paul, Minnesota, U.S.A. Routes: Transcontinental U.S. network and to Honolulu, Alaska, Japan, China and the Philippines; mileage 17,555. Fleet: 10 Boeing Stratocruisers, 18 Douglas DC-4s, and 2 Douglas DC-3s.

Nuvegacao Aerea Brasileira (N.A.B.), Rio de Janeiro, Brazil. Routes: Domestic.

Organisaçao Mineira de Transportes Aereos (OMTA), Belo Horizonte, Brazil.—See Consôrcio Nacional de Transportes Aéreos.

Orient Airways, Ltd., Karachi, Pakistan. Routes: Between East and West Pakistan and to India and Burma; mileage 5,511. Fleet: 3 Convair 240s, 18 Douglas DC-3s, 1 Beechcraft and 2 Stinson L-5s. Traffic ton-miles 5,762,180.

Overland Air Services (Pty.), Ltd., Sydney, N.S.W., Australia. Routes: Local; mileage 330. Fleet: Lodestars.

Ozark Air Lines, Inc., St. Louis, Mo, U.S.A. Feederline routes in Arkansas, Indiana, Iowa, Oklahoma, Kentucky, Kansas, Missouri, Illinois and Tennessee. Fleet: 10 Douglas DC-3s.

Pacific Northern Airlines, Seattle, Washington, U.S.A. Routes: In Alaska and between U.S.A. and Alaska. Fleet: Douglas DC-4s, Douglas DC-3s and Lockheed 12s. Traffic ton-miles 6,719,773.

Pacific Northern Airlines, Seattle, Washington, U.S.A. Routes: In Alaska and between U.S.A. and Alaska; mileage 1,700. Fleet: 2 DC-4s, 4 DC-3s and 3 others.

Panagra (Pan American-Grace Airways, Inc.),* New York City, N.Y., U.S.A. (Associate of Pan American World Airways.) Routes: In and through South America from Buenos Aires to Panama and Miami; mileage 8,784. Fleet: 6 Douglas DC-6s, 2 Douglas DC-6Bs, 4 Douglas DC-4s and 10 Douglas DC-3s. Traffic ton-miles 17,910,923.

Pan American World Airways, Inc., New York, N.Y., U.S.A. Routes: Extensive world network, from U.S. to Central and South America, Europe, Africa, India, China, Malaya, Australia, New Zealand, Japan, Honolulu, and Alaska; mileage 60,218. Fleet: 28 Boeing Stratocruisers, 20 Lockheed Constellations, 48 Douglas DC-6Bs, 3 DC-6As, 60 DC-4s and 16 Convair 240s. On order: 3 de Havilland Comet 3s.

Panair do Brasil, S.A.,* Rio de Janeiro, Brazil. (Subsidiary of P.A.W.A., principal Brazilian international airline.) Routes: Domestic and to Argentina, Chile, Europe, the Near East, Paraguay, Uruguay and West Africa; mileage 20,500. Fleet: 7 Lockheed Constellations, 19 Douglas DC-3s and 4 Convair Cansos; 4 de Havilland Comet 2s on order and option held on 2 Comet 3s.

Philippine Air Lines, Inc.,* Manila, Philippines (the Philippine national airline). Routes: Inter-island services and trunk routes to Europe, U.S.A., and Japan; mileage 24,500. Fleet: 2 Douglas DC-6Bs, 4 DC-6s, DC-3s and 6 Convair 340s (on delivery).

Piedmont Airlines, Winston-Salem, North Carolina, U.S.A. Feederline routes in North and South Carolina, Kentucky, Ohio, Tennessee, Virginia and West Virginia. Fleet: 14 Douglas DC-3s.

Pioneer Air Lines, Inc., Dallas, Texas, U.S.A. Routes: Local services in Texas and New Mexico. Fleet: 9 Martin 2-0-2s. Traffic ton-miles 5,128,361.

Pluna (Primeras Lineas Uruguayas de Navigacion Aerea), Montevideo, Uruguay. Routes: Domestic services and to Brazil and the Argentine; mileage 1,300. Fleet: 5 DC-3s.

Qantas Empire Airways, Ltd., Sydney, N.S.W., Australia. Routes: Some domestic and to New Guinea and the Pacific Islands, Japan, Malaya, India, Ceylon, South Africa and Europe; mileage over 20,000. Fleet: 6 Lockheed Constellations, 5 Douglas DC-4s, 13 DC-3s, 4 de Havilland Drovers, 4 Short Sandringhams and 3 Convair Catalinas. On order: 3 Lockheed Super Constellations.

Quebecair Inc. (late Rimouski Airlines, Ltd.), Rimouski, Quebec, Canada. Routes: Local. Fleet: 5 Douglas DC-3s, 3 D.H. Beavers, 1 Beech 18 and 1 Cessna Crane.

Queen Charlotte Airlines, Ltd., Vancouver, British Columbia, Canada Routes: Services in British Columbia (southern area). Fleet: Douglas DC3s and Convair Cansos.

Queensland Airlines Pty., Ltd., Brisbane, Queensland, Australia. Routes: In Queensland and New South Wales. Fleet: Douglas DC-3s.

REAL (Redes Estaduais Aereas, Ltda.), São Paulo, Brazil. Routes: Domestic and to Paraguay; mileage 3,000. Fleet: 28 Douglas DC-3s and 4 Curtiss C-46s.

Reeve Aleutian Airways, Inc., Anchorage, Alaska. Routes: To the Aleutians. Fleet: Douglas DC-3s.

S.A. Viaçao Aerea Gaucha (Savag), Rio Grande do Sul, Brazil. Routes: Domestic. Fleet: Douglas DC-3s.

Sabena (Société Anonyme Belge d'Exploitation de la Navigation Aérienne—Belgian Airlines),* Brussels, Belgium. Routes: European and African networks and between Belgium and New York, Israel, Belgian Congo and Johannesburg; mileage 50,000. Fleet: 5 Douglas DC-6s, 7 DC-4s, 6 Convair 240s, 25 DC-3s, 4 Doves and 3 Bell 47 helicopters. On order, 8 DC-6Bs and 2 DC-6As. Traffic ton-miles 38,900,000.

SATA (Sociedade Acoriana de Transportes Aéreos, Lda.), Ponta Delgada, Azores. Routes: Local; mileage 380. Fleet: 2 de Havilland Doves.

Saskatchewan Government Airways, Prince Albert, Saskatchewan, Canada. Routes: Local.

Saudi Arabian Airlines, Jeddah, Saudi Arabia. Routes: Domestic and to Egypt, the Lebanon, Syria and Persian Gulf. Fleet: 12 Douglas DC-3s and 5 Bristol 170s.

Scandinavian Airlines System,* Stockholm, Sweden. (Comprising Danish, Norwegian and Swedish Air Lines.) Routes: European network, Scandinavian domestic services and between Scandinavia and North and South America, East and South Africa, Near and Middle East, Pakistan, India, Burma, Thailand and Japan; mileage 59,674. Fleet: 8 Douglas DC-6Bs, 12 DC-6s, 9 DC-4s, 18 DC-3s, 6 Saab Scandias and 2 Junkers-Ju52/3ms. On order, 6 DC-6Bs. Traffic ton-miles 93,600,000.

Servicio Aereo de Honduras, S.A. (SAHSA), Tegucigalpa, Honduras. (Associate of Pan American World Airways.) Routes: Within the Republic of Honduras; mileage 2,644. Fleet: 4 Douglas DC-3s.

Servicos Aereos Cruzeiro do Sul, Ltda., Rio de Janeiro, Brazil. Routes: Domestic and to Buenos Aires; mileage 10,500. Fleet: 2 Douglas DC-4s and 31 DC-3s.

Skoga, Pekin, China. Route: Pekin-Moscow in conjunction with Aeroflot.

Slick Airways, Inc., San Antonio, Texas. Routes: Transcontinental freight services and transatlantic service for P.A.W.A. Fleet: Douglas DC-6As and Curtiss C-46s.

SOBELAIR (Société Belge de Transports par Air, S.A.), Brussels, Belgium. Routes: Non-scheduled between Belgium and the Belgian Congo. Fleet: 5 Douglas DC-3s.

Sociedad Aerea del Tolima, S.A. (Saeta), Bogota, Colombia. Routes: Local; mileage 1,760. Fleet: 4 Douglas DC-3s.

South African Airways,* Johannesburg, Union of South Africa. Routes: Domestic and to Southern Rhodesia, Mozambique, Kenya, Sudan, Italy, Germany and United Kingdom; mileage 15,374. Fleet: 4 Lockheed Constellations, 7 Douglas DC-4s, 3 Douglas DC-3s and 11 Lockheed Lodestars. Traffic ton-miles 13,448,644.

South Coast Airways (Pty.), Ltd., Wollongong, N.S.W., Australia. Routes: Local; mileage 272. Fleet: DC-3s and Lockheed Electras.

Southern Airways, Inc., Atlanta, Georgia, U.S.A. Routes: Services in the Southern States. Fleet: 10 Douglas DC-3s. Traffic ton-miles 2,152,345.

South West Air Transport (Pty.), Ltd., Windhoek, South West Africa. Routes: Local. Fleet: Ryan Navions.

Southwest Airways Company, South San Francisco, California, U.S.A. Feederline routes in California and to Medford, Oregon. Fleet: 10 DC-3s and 4 Martin 2-0-2s.

STA (Serviço de Transportes Aéreos), Sao Tomé, Gulf of Guinea. Routes: Local; mileage 350. Fleet: 2 de Havilland Dragon Rapides and 1 Auster Autocar.

Sudan Airways, Khartoum, Sudan. Routes: Domestic; mileage 3,000. Fleet: de Havilland Doves and Auster. On order, Douglas DC-3s. Traffic ton-miles 427,682.

Swissair* (Swiss Air Transport Co., Ltd.), Zurich, Switzerland. Routes: European network and between Switzerland and Egypt, Israel and New York; mileage 23,202. Fleet: 3 Douglas DC-6Bs, 4 Convair 240s, 3 DC-4s, 13 DC-3s and 3 D.H. Rapides. On order, 3 DC-6Bs. Traffic ton-miles 23,700,000.

Syrian Airways Company, Damascus, Syria. Routes: Domestic. Fleet: Douglas DC-3s.

TABSO (Bulgarski Vzduszni Linii), Sofia, Bulgaria (the Bulgarian-Soviet airline). Routes: Domestic. Fleet: LI 2s (Soviet DC-3s); reported to have IL 12s.

T.A.C. (Empreza de Transportes Aéreos Catarinense, S.A.), Florianopolis, Brazil. Routes: Domestic. Fleet: Douglas DC-3s.

Taca de Costa Rica, S.A., San Jose, Costa Rica. Routes: Domestic. Fleet: 4 Douglas DC-3s.

Taca de Honduras, Tegucigalpa, Honduras. Routes: Domestic. Fleet: Douglas DC-3s.

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Taca International Airlines, S.A., New Orleans, Louisiana, U.S.A. Routes: Serving Mexico, Costa Rica, Guatemala, Nicaragua, El Salvador, British Honduras and Honduras. Fleet: 3 Douglas DC-4s and 2 DC-3s.

TAE (National Greek Airlines),* Athens, Greece. Routes: Domestic and to Cyprus, Egypt, France, Israel, Italy, United Kingdom. Yugoslavia and Turkey. Fleet: 1 Douglas DC-4 and 18 DC-3s.

T.A.I.,* (Compagnie de Transports Aériens Intercontinentaux), Paris, France. Routes: From France to Morocco, French West Africa, Madagascar and French Indo-China. Fleet: 5 Douglas DC-4s, 4 Armagnacs. On order, 3 DC-6Bs. Traffic ton-miles 14,600,000.

TAP* (Transportes Aéreos Portugueses), Lisbon, Portugal. (Principal Portuguese airline.) Routes: Domestic and to France, Spain, United Kingdom and Portuguese Africa; mileage 7,500. Fleet: 3 DC-4s and 6 DC-3s.

TARS (Societate Româno-Sovietică de Transporturi Aeriene), Bucharest, Roumania (the Roumanian-Soviet airline). Routes: Domestic and to Czechoslovakia, Hungary and Poland; mileage 1,500. Fleet: 16 LI 2s. Reported to have 5 IL 12s.

Tasman Empire Airways, Ltd., Auckland, New Zealand. Routes: New Zealand to Australia, Fiji, and Chatham Island; mileage 4,602. Fleet: 4 Short Solents.

Thai Airways Company, Ltd. (TAC), Bangkok, Siam. Routes: Domestic and to Burma, French Indo-China, India and Singapore. Fleet: Douglas DC-4s, DC-3s, Beech Bonanzas and Noorduyn Norseman.

The Flying Tiger Line, Inc., Burbank, California, U.S.A. Routes: Freight services only. Trans-continental from Boston, New York and Philadelphia through Cleveland and Chicago to Portland, Seattle, San Francisco, Los Angeles and San Diego; mileage 10,506. Fleet: 11 Douglas C-54s and 26 Curtiss C-46s. Cargo ton-miles 41,584,387.

TPA Aloha Airline, Honolulu, Hawaii. Routes: Inter-Island; mileage 1,007. Fleet: 5 Douglas DC-3s. Traffic ton-miles 1,849,605.

Townsville and Country Airways (Pty.), Ltd., Townsville, Queensland, Australia. Routes: Local; mileage 500. Fleet: Douglas DC-3s.

Trans-Australia Airlines† Melbourne, Victoria, Australia. Government-formedairline. Routes: Throughout Australia; mileage 21,500. Fleet: 5 Convair-Liners, 3 Douglas DC-4s, 22 DC-3s, and 5 D.H. Drovers; 6 Vickers Viscounts on order.

Trans-Canada Air Lines,* Montreal, Canada. Routes: Trans-continental and between Canada and the U.S.A., Bermuda, Barbados, Trinidad, Nassau, Kingston, United Kingdom, Paris and Düsseldorf. Fleet: 23 Canadair North Stars and 27 Douglas DC-3s. On order, 15 Vickers-Armstrongs Viscount 724s and 8 Lockheed Super Constellations.

Trans Mar de Cortes, Guaymas, Mexico. Routes: Domestic services. Fleet: Douglas DC-3s.

Trans Oceanic Airways, Sydney, N.S.W., Australia. Routes: Sydney to Lord Howe Island and Hobart. Fleet: 2 Short Solents and 1 Short Hythe.

Transportes Aereos de Jalisco, S.A., Guadalajara, Mexico. Routes: Domestic. Fleet: 4 Douglas DC-3s.

Transportes Aereos Militares (Peru), Lima, Peru. Routes: Domestic. Fleet: Douglas DC-3s, D.H. Rapides and Stinsons.

Transportes Aereos Nacional, Ltda., Rio de Janeiro, Brazil.—See Consórcio Nacional de Transportes Aereos.

Transportes Aereos Nacionales, S.A. (TAN Airlines), Miami, Florida, U.S.A. Routes: To Cuba, Honduras, Nicaragua and El Salvador.

Transportes Aereos Salvador Ltda., Sao Salvador, Brazil. Routes: Local. Fleet: 2 de Havilland Herons.

Trans-Texas Airways, Houston, Texas, U.S.A. Feederline routes in Texas. Fleet: 9 Douglas DC-3s

Trans World Airlines, Inc., Kansas City, Missouri, U.S.A. Routes: Extensive internal U.S. and world network to Europe, Africa, Asia, India and Ceylon; mileage 33,000. Fleet: 66 Lockheed Constellations, 10 Super Constellations, 12 Martin 2-0-2As, 40 Martin 4-0-4s (in course of delivery), 14 Douglas DC-4s and 51 DC-3s.

Trust Territory Operations, Guam, Marianas Islands (operated by Transocean Air Lines). Routes: To Caroline Is., Palau, and Marshall Islands. Fleet: Convair Cansos.

Tunis Air (Société Tunisienne de l'Air), Tunis, Tunisia. Routes: To France, Algeria, Italy, Corsica and Tripoli. Fleet: 4 Douglas DC-3s and Languedoc. Traffic ton-miles 1,480,000.

UAT* (Union Aéromaritime de Transport), Paris, France. Routes: To French Africa and French Indo-China. Fleet: 3 de Havilland Comet 1As, 4 Douglas DC-4s, 3 de Havilland Herons and 3 Douglas DC-3s. On order, 4 de Havilland Comet 2s and 6 de Havilland Herons. Traffic ton-miles 16,660,000.

Union of Burma Airways (UBA), Rangoon, Burma. Routes: Domestic and to Thailand. Fleet: 10 Douglas DC-3s, 5 D.H. Doves and 3 Handley Page Marathons.

United Air Lines, Inc.,* Chicago, Ill., U.S.A. Routes: Trans-continental, and U.S. West Coast to Honolulu; mileage 13,250. Fleet: 19 DC-6Bs, 41 DC-6s, 23 Convair 340s, 6 Boeing Stratocruisers, 23 Douglas DC-4s and 152 Douglas DC-3s. On order, 32 Convair 340s, and 25 Douglas DC-7s. Traffic ton-miles 310,530,000.

Uraba, Medellin and Central Airways, Inc. (UMCA), Medellin, Colombia. Routes: Balboa to Medellin. Fleet: Douglas DC-3s.

VARIG* (S.A. Empresa de Viação Aerea Rio Grandense), Porto Alegre, Brazil. (Pioneer Brazilian airline.) Routes: Domestic and to the Argentine and Uruguay. Fleet: 23 Douglas DC-3s, 14 Curtiss C-46s and 2 Lockheed Electras.

VASP (Viação Aérea Sao Paulo, S.A.), Sao Paulo, Brazil (important Brazilian airline). Routes: Domestic; mileage 3,200. Fleet: 30 Douglas DC-3s and 6 Saab Scandias. On order: 6 Saab Scandias.

Vestlandske Luftfartselskap A.S. (West-Norway Airlines), Bergen, Norway. Routes: Bergen to Trondheim and Stavanger. Fleet: 2 Short Sealands, 3 Republic Seabees and 1 Supermarine Walrus.

Viaçao Aerea Brasil, S.A., Rio de Janeiro, Brazil.—See Consorcio Nacional de Transportes Aereos.

West African Airways Corporation,* Lagos, Nigeria. Routes: Domestic and to Gold Coast, Sierra Leone, Gambia, Senegal and the Sudan; mileage 5,000. Fleet: 9 de Havilland Doves, 6 Handley Page Miles Marathons and 5 Bristol 170s. Traffic ton-miles 1,824,379.

West Coast Airlines, Seattle, Washington, U.S.A. Feederline routes in Washington and Oregon. Has absorbed Empire Air Lines. Fleet: 6 Douglas DC-3s.

Western Air Lines, Inc., Los Angeles, California, U.S.A. Routes: In 12 Western States and Los Angeles to Edmonton and Denver to Edmonton and Minneapolis-St. Paul; mileage 5,500. Fleet: 5 DC-6Bs, 10 Convair 240s, 5 DC-4s and 10 DC-3s.

Wheeler Airlines, Ltd., St. Jovite, Quebec, Canada. Route: Montreal to St. Jovite. Fleet: Avro Ansons.

Widerøe's Flyveselskap og Polar-By A.S., Oslo Norway. Route: Narvik-flodö in summer. Fleet: Noorduyn Norseman.

Wien Alaska Airlines Inc., Fairbanks, Alaska. Routes: Domestic. Fleet: 2 Curtiss C-46s, Douglas DC-3s, Cessna 170 and 195 and Noorduny Norseman. Traffic ton-miles 984,710.

Wiggins Airways, Norwood, Mass., U.S.A. Feederline routes in Massachusetts, Connecticut, New Hampshire, New York, and Rhode Island. Fleet: 6 Cessna T-50s.

Wisconsin Central Airlines, Inc., Madison, Wisconsin, U.S.A. Feederline routes in Illinois, Michigan, Minnesota and Wisconsin; mileage 300. Fleet: 6 Douglas DC-3s.

Woods Airways (Pty.), Ltd., Perth, Western Australia. Routes: Perth to Rottnest Island; mileage 25. Fleet: Avro Ansons.

BRITISH AIR SERVICES

The Government's Policy: Division of Routes Between State and Private Operators

AN official definition of Government policy towards air transport states that it is designed "to help forward the sound development of civil aviation, to reduce the cost of air transport to the taxpayer and to give greater opportunities to private enterprise . . . without in any way impairing the competitive strength of our international air services." Certain existing routes are accordingly reserved for B.E.A. and B.O.A.C.; development of new routes and new types of scheduled services is open to the independent operators and the Corporations alike. The decision as to whether Corporations or independents are licensed to operate these new routes is taken by the Minister of Civil Aviation on the basis of applications submitted, in the first place, to the Air Transport Advisory Council. It is the Council's duty to examine all the applications and to pass on its recommendations to the Minister; the Council's terms of reference are clearly defined, and its experience in interpreting policy is such that its recommendations are usually accepted.

Since the majority of the profitable international routes centred on Britain are already operated by the Corporations, the main opportunities open to the independents under this policy are as follows: seasonal tours; domestic and short-range international scheduled passenger services; secondary internal services not operated by B.E.A.; vehicle ferry services; "colonial coach" services (scheduled passenger flights on Commonwealth routes at fares lower than the I.A.T.A. tourist rate); new all-freight services. The Corporations have undertaken not to apply to operate new all-freight services until July 14th, 1953, thus giving the independents a year in which to put forward applications and plan their operations. Independent operators cannot be subsidized.

One of the most important features of the new policy is that operators are licensed for seven (and, in some cases, ten) years, thus providing a stability lacking under the previous system and helping companies to raise capital for new aircraft.

The main first- and second-class services reserved for the Corporations are summarized below :—

B.O.A.C. From London to: Sydney, Tokyo, Hong Kong, Singapore, Bombay or Colombo, Cairo or Tel Aviv, Teheran, Baghdad, Bahrein, Entebbe or Nairobi, Johannesburg, Lagos or Accra, Lisbon, Montreal, New York, Shanghai, Auckland, Bermuda or Nassau, Kingston, Rio de Janeiro, Buenos Aires or Santiago. All-freight service from London to Singapore.

B.E.A. From London to: Barcelona, Bordeaux, Madrid, Gibraltar, Palma, Zurich, Geneva, Basle, Vienna, Paris, Nice, Deauville, Dinard, Le Touquet, Brussels, Dusseldorf, Berlin, Cologne, Hanover, Frankfurt, Amsterdam, Copenhagen, Stockholm, Oslo, Rome, Milan, Malta, Istanbul, Cyprus, Tripoli, Benghazi, Athens. From Belfast, Glasgow, Manchester and Birmingham to: Amsterdam, Zurich, Geneva, Paris. All-freight services to: Amsterdam, Hamburg, Berlin, Copenhagen, Stockholm, Paris, Brussels, Hanover, Nice, Rome, Malta, Milan, Athens, Istanbul, Zurich, Vienna.

At the time of writing, over 170 applications had been submitted to the A.T.A.C. since the new terms of reference were issued last July. Subject to "certain conditions being satisfied," the Minister of Civil Aviation has approved the applications shown in the table overleaf. No decision has yet been announced in many cases but it is expected that several approvals will be announced in the near future, enabling more operators to complete their plans for new services.

Under the Air Corporation Act of 1949, independent companies may operate scheduled services only if appointed to do so by the Corporations under "associate agreements."

(Tabulated lists of approved applications, correct to February 26th, and of the British Independent Operators, appear overleaf.)

BRITISH AIR SERVICES . . . APPLICATIONS APPROVED

Operator and Aircraft	Routes	Type of Service	Agreement Expires
Air Kruise (Kent), Ltd. Rapide	Lympne-Le Touquet	Normal sched.	31.3.60
	Lympne-Ostend *via* Ramsgate	Normal sched.	31.3.60
	Ramsgate - Le Touquet *via* Lympne...	Normal sched.	31.3.60
Airlines (Jersey), Ltd. Rapide	Gatwick-Southampton (opt.)-Alderney - Guernsey and/or Jersey-St. Brieuc-Lannion-Brest	Normal sched.	31.3.63
	Manchester-Coventry and/or Bournemouth-Guernsey and/or Jersey-Dinard-Rennes-La Baule	Normal sched.	31.3.63
	Exeter-Guernsey and/or Jersey-Caen-Paris	Normal sched.	31.3.63
Airwork, Ltd. Viking, York, Tudor, Hermes	London-Nairobi *via* Nice, Malta, El Adem or Mersa Matruh and Luxor (N. bound only), Wadi Halfa, Khartoum, Juba and Entebbe	Colonial coach	1960
	London-Canada	All-freight	1963
	London-U.S.A....	All-freight	1963
	London-Aden	All-freight	1960
Aquila Airways Ltd. Hythe and Solent.	*Southampton-Madeira via Lisbon*	Sched. pass. and freight	31.12.55
B.K.S. Aerocharter, Ltd. DC-3	Newcastle-Ronaldsway ...	Sched. pass.	1960
	Newcastle and/or W. Hartlepool-Jersey	Sched. pass.	1960
B.E.A.	Manchester-Amsterdam-Dusseldorf	Normal sched.	20.11.59
B.O.A.C.	London - Rome - Cairo - Khartoum-Entebbe-Dar-es-Salaam .	Normal sched.	20.11.59
Cambrian Air Services, Ltd. Rapide, Dove	Haverfordwest-Cardiff *via* Swansea (later extension to London *via* Bristol)	Sched. pass.	1963
	Cardiff-Dinard	Sched. pass.	1963
	Cardiff-Paris *via* Southampton	Sched. pass.	1963
	Liverpool-Cardiff and/or Bristol-Guernsey and/or Jersey ...	Sched. pass.	1963
	Manchester-Cardiff and/or Bristol-Guernsey and/or Jersey ...	Winter sched. pass.	1963
	Liverpool - Cardiff - Southampton-Guernsey-Jersey	Sched. pass.	8.4.56
Don Everall (Aviation), Ltd. Rapide	Birmingham-Guernsey-Jersey..	Sched. pass.	31.12.59
	Wolverhampton-Ronaldsway ..	Sched. pass.	1960
	Birmingham-Newcastle *via* Leicester East and Nottingham	Sched. pass.	1960
Eagle Aviation Ltd.	London-Belgrade *via* Munich (technical stop)	Normal sched.	1960
East Anglian Flying Services, Ltd. Rapide	Ipswich-Southend-Ostend ...	Sched. pass.	31.3.60
	Ipswich - Rochester - Southend-Brighton-Paris	Sched. pass.	31.3.60
	Brighton-Dieppe	Sched. pass.	31.3.60
	Ipswich - Southend-Rochester-Shoreham-Jersey	Sched. pass.	31.3.60
	Southend - Rochester - Shoreham - Jersey	Sched. pass.	1.10.55
Hunting Air Transport, Ltd. Viking.	London - Nairobi *via* Nice, Malta, El Adem or Benina or Mersa Matruh and Luxor (N. bound only), Wadi Halfa, Khartoum, Juba and Entebbe	Colonial coach	1960
Lancashire Aircraft Corporation, Ltd. DC-3, Rapide, Consul.	*Birmingham-Ronaldsway ...*	Sched. pass. and freight	1.4.56
	Blackpool-Ronaldsway	Sched. pass. and freight	1.4.56
Manx Air Charters, Ltd. Rapide	Ronaldsway-Newcastle ...	Sched. pass.	1960
	Ronaldsway-Carlisle	Sched. pass.	1956
	Ronaldsway-Glasgow	Sched. pass.	1960
Morton Air Services, Ltd. Dove, Rapide, Consul, later Heron	Croydon-Jersey-Guernsey ...	Summer w'end Sched. pass.	1959
	Bristol-Paris	Sched. pass.	1960
	Bristol-Jersey and/or Guernsey	Sched. pass.	1960
Olley Air Service, Ltd. Rapide, Consul, Dove.	Croydon-Jersey-Guernsey ...	Summer w'end Sched. pass.	1959
Murray Chown Aviation, Ltd. Rapide.	*Cheltenham - Hurn - Guernsey Jersey ... ...*	Sched. pass.	30.9.55
Silver City Airways, Ltd. Bristol 170	*Lympne-Le Touquet ... ...*	Sched. vehicle, freight and pass.	31.12.61
	Southampton-Cherbourg ...	Sched. vehicle, freight and pass.	31.12.61
Scottish Aviation, Ltd. DC-3, Rapide.	*Prestwick-Ronaldsway ... ...*	Sched. pass. and freight	30.9.55
Starways, Ltd. DC-3, Rapide, Anson	Liverpool-Lourdes	Incl. tour	31.10.57
	Liverpool-Bilbao	Incl. tour	1958
	Liverpool-Ronaldsway ...	Sched. pass.	1956
Transair, Ltd. Anson, DC-3.	Croydon or Gatwick-Guernsey and/or Jersey	Summer w'end sched. pass.	1960

N B.—The companies named have been approved to operate the adjoining routes, but are not necessarily operating services at present. Entries in italics show long-term agreements approved under the former Government policy; not shown here are a large number of current agreements, approved under earlier policy, which expire at the end of this month. The list of agreements tabulated above will be supplemented from time to time as the Minister's decisions are announced.

BRITISH INDEPENDENT OPERATORS

SINCE the individual activities of the British independent airline and charter companies are normally on a far smaller scale than those of the State Corporations, their contribution to the overall British effort in the field of air transport is correspondingly less publicized and less well-known. Collectively, however, the independents' operations are widespread, covering every type of service from long-range trooping to local pleasure flying, and involving the use of over 250 multi-engined aircraft.

In the following table we have attempted to show the size and scope of each of the many British companies engaged in scheduled or irregular carriage of passengers or freight either in association with state airlines under government contract or on a charter basis. Wherever possible we have shown the types and numbers of aircraft which comprise a company's fleet, and given an indication of traffic in the calendar year 1952. In doing so, we acknowledge the co-operation of the several companies who provided such data.

Operator	Head Office	Main Base(s)	Senior Executives	Main Transport Activities	Aircraft Fleet	1952 Traffic
Air Charter, Ltd.**	15, Great Cumberland Place, London, W.1 (Amb. 2091).	Stansted.	F. A. Laker (chmn.), G. W. Forster (traff. mgr.).	Charter passengers and freight.	8 Yorks, 4 Tudors, 1 Dakota, 1 Rapide, 1 Bristol 170 (more 170s on order).	9,936 pass.; 4,252,768 rev. ton-miles.
Air Couriers (Transport), Ltd.	Croydon Airport, Surrey (Croydon 7744)	Croydon.	G. G. Glanville (chmn.), F. W. Griffin (traff. mgr.).	Charter (press, race meeting, pass., etc.).	2 Rapides, 1 Gemini.	——
Air Enterprises, Ltd.**	Croydon Airport, Surrey (Croydon 7744)	Croydon and Renfrew.	F. W. Carr (chmn.), P. D. May (traff. mgr.).	Contract (mainly industrial and Air Ministry).	4 Consuls, 2 Rapides, 1 Prince (optd. on contract).	——
Air Kruise (Kent), Ltd. Trans-Channel Airways.	Lympne Airport, Hythe, Kent. (Hythe 6644).	Lympne and Ramsgate.	W/C. H. C. Kennard (chmn.), A. W. Ross (traff. mgr.).	Scheduled and charter pass.	5 Rapides, 1 Messenger, 2 Proctors, 3 Austers.	12,500 pass.
Air Navigation and Trading Co., Ltd.	36, Kensington Road, Blackpool. Blackpool 21121.	Squires Gate and Kingstown	R. L. Whyham (chmn.).	Trawler-crew replacement service and gen. charter.	3 Ansons, 3 Avro 19s, 3 Rapides, 2 Dragons, 10 s-eng. types.	13,500 pass.
Airways Union, Ltd.*	The Airport, Weston-super-Mare, Somerset. (Western 2700.)	Exeter and Roborough.	R. King-Farlow (chmn.), S. J. Cox (traff. mgr.).	Charter, club, pleasure flights, hire.	2 Geminis, 1 Messenger, 2 Austers, 1 Proctor, 3 Tiger Moths.	3,934 pass.
Airwork, Ltd.	15, Chesterfield Street, London, W.1. (Gro. 4841.)	Blackbushe.	M. D. N. Wyatt (chmn.), I. J. Edwards (traff. mgr.).	Scheduled contract and charter, pass. and freight.	10 Vikings, 1 Dakota, 3 Hermes, 1 Consul.	59,490 pass.; 673,811 lb. freight.

Contd. opposite

Operator	Head Office	Main Base(s)	Senior Executives	Main Transport Activities	Aircraft Fleet	1952 Traffic
Aquila Airways, Ltd.	6, Curzon Place, Park Lane, London, W.1. (Gro. 3947.)	Southampton.	W/C. B. T. Aikman (chmn.), R. J. Clark (ops. mgr.).	Scheduled and charter pass. and freight.	1 Solent, 2 Hythes.	7,270 pass. and 75 tons freight on scheduled services.
Bees Flight, Ltd.	Bowcombe,Carisbrooke Isle of Wight. (Newport 2946.)	Sandown.	J. P. Stephenson Clarke (chmn.), M. Wilkins (traff. mgr.).	Charter passenger and freight; pleasure flights.	1 Rapide, 2 Geminis, 1 Autocar, 1 Auster.	—
Birkett Air Service, Ltd.*	237, Acton Lane, London, W.4. (Chiswick 3000.)	Croydon.	Capt.G.Birkett (chmn.), Maj. G. T. Baxter (ops. mgr.).	Scheduled and charter pass.	3 Rapides, 1 Proctor.	—
B.K.S. Aerocharter, Ltd.	Dorset House, Old Burlington Street, London, W.1. (Gro. 7478).	Southend.	C. J. Stevens (chmn.).	Charter pass. and freight.	4 Dakotas.	3,750 pass.; 35 tons freight; 2,050,000 rev. ton-miles.
Cambrian Air Services, Ltd.**	Cardiff Airport, Cardiff. (Cardiff 44418).	Cardiff and Haverford-west.	J. H. Watts (chmn.), B. J. T. Callan (traff. mgr.).	Scheduled and charter pass.; contract flying.	5 Rapides, 2 Proctors, 1 Auster.	8,752 pass.; 145,375 rev. ton-miles.
Crowflight, Ltd.	T. Hayhow (chmn.) E. Taylor (traff. mgr.)	Trafalgar St., Thornaby-on-Tees.	Greatham.	Charter passenger.	1 Proctor. 1 Aiglet.	90 passengers.
Derby Aviation, Ltd.	78, Buckingham Gate, London, S.W.1. (Abb. 2345.)	Derby.	G/C. C. A. B. Wilcock (chmn.), S/L. S. Loveridge (traff. mgr.).	Charter pass.	3 Rapides, 1 Anson 19, 2 Geminis, 1 Messenger.	557 pass.
Don Everall (Aviation), Ltd.	Birmingham Airport, Elmdon, Birmingham. 26. (Sheldon 2631.)	Birmingham.	D. Everall (chmn.), A. D. Atkinson (traff. mgr.).	Scheduled and charter pass. and freight; air photography.	3 Rapides, 1 Messenger, 1 Auster. On order: 1 Rapide.	712 pass. (charter); 375 pass. (schedule); 75,000 miles flown.
Eagle Aviation, Ltd.**	29, Clarges Street, London, W.1. (Gro. 6411.)	Blackbushe.	H. Bamberg (man. dir.)# G. W. Pitt (traff. mgr.).	Scheduled, contract and charter pass. and freight.	4 Dakotas.	3,095 pass. and 28,800,250 pass-miles in yr. ended July,1952
East Anglian Flying Services, Ltd. (Channel Airways)	Southend Airport, Southend. (Rochford 56460.)	Southend.	S/L. R. J. Jones (chmn.), D. Burgess (traff. mgr.).	Scheduled and charter pass., freight and mail.	4 Rapides. (To re-equip with Herons.)	2,800 scheduled services; 400 charter.
Flight Refuelling, Ltd.	Tarrant Rushton Airfield, Blandford, Dorset. (Blandford 501.)	Tarrant Rushton.	Sir Alan J. Cobham (chmn.), T. C. Marks (traff. mgr.).	Tanker service for refuelling in flight; transport of liquid cargoes.	2 Lancasters.	—
Flightways, Ltd.	Southampton Airport, Southampton. (Eastleigh 87669.)	Southampton.	V. H. Bellamy (chmn.), S. F. Richardson (traff. mgr.).	Charter pass. and freight; contract flying.	4 Rapides, 1 Proctor.	1,040 pass.; 10 tons freight.
Herts and Essex Aero Club (1946), Ltd.	Broxbourne Aerodrome, Nazeing, Essex.	Broxbourne.	A. Frogley (chmn.), F. Darlow (traff. mgr.).	Charter pass.	1 Rapide, 2 Geminis, 9 s-eng. types.	560 pass.
Hunting Air Transport, Ltd.**	5, Fitzhardinge Street, Portman Square, London, W.1. (Wel. 7799.)	Bovingdon.	P. L. Hunting (chmn.), R. Wingrave (traff. mgr.).	Scheduled pass. and freight services; contract and charter pass. and freight services.	8 Vikings, 1 Dakota.	Total miles flown, 2,551,912; pass. carried, 59,054 (38,515 contract charter, 2,017 scheduled).
I.A.S. (London) Ltd., Island Air Services	M. Rendall (chmn.) J. Edwards (traff. mgr.)	Lon. Airport (Hounslow 7711).	L.A.P. and Croydon.	Charter passenger and pleasure.	2 Rapides.	—
Jersey Airlines**	4, The Parade, St. Helier, Jersey, Channel Is.	Jersey.	M. L. Thomas (chmn.), D. le Calvez (traff. mgr.),	Scheduled and charter pass.; survey.	6 Rapides. On order: 1 Heron.	25,960 pass.; 299,363 rev. ton-miles.
Loxhams Flying Services, Ltd.**	Penny Street, Lancaster (Lancaster 868).	Blackpool.	E. Bradshaw (chmn.), C. Ashley (traff. mgr.).	Charter pass. and freight.	5 Austers, 1 Hawk Trainer.	—
Marshall Flying Services, Ltd.	The Aerodrome, Newmarket Road, Cambridge. (Cam. 56291.)	Cambridge.	A. G. G. Marshall (chmn.), H. E. Tappin (traff. mgr.).	Charter pass.	3 Rapides.	1,300 pass.
Manx Airlines, Ltd.	Ronaldsway Airport, Ballasalla, Isle of Man. (Castletown 3286.)	Ronaldsway	Capt. G. H. Drummond (chmn.), T. Kavanagh (traff. mgr.).	Scheduled and charter pass. and freight.	4 Rapides.	4,000 pass. (schedule) 1,000 (charter).
Morton Air Services, Ltd.**	Croydon Airport, Surrey. (Croydon 7744.)	Croydon.	Capt. T. W. Morton (chmn.), P. L. Eskell (traff. mgr.).	Scheduled and charter pass. and freight.	3 Doves, 3 Consuls, 3 Rapides.	—
Murray Chown Aviation, Ltd.	Staverton Airfield, Cheltenham, Glos. (Churchdown 3292.)	Staverton.	M. Chown (chmn.), G. Hansen (sec.).	Scheduled pass.	1 Rapide.	—
Olley Air Service, Ltd.**	Croydon Airport, Surrey. (Croydon 5117/9.)	Croydon.	Capt. T. W. Morton (chmn.), S. A. Carter (traff. mgr.).	Scheduled and charter pass.	2 Rapides, 2 Consuls, 1 Dove (more on order).	7,050 pass.
Patrick Aviation, Ltd.	479, Bristol Road, Birmingham, 29. (Selly Oak 1104.)	Elmdon.	J. A. M. Patrick (man. dir.), W. Towler (dir. and sec.).	Charter pass. and freight.	2 Rapides.	—
Scottish Airlines (Scottish Aviation Ltd.)**	Prestwick Airport, Scotland. (Prestwick 7272.)	Prestwick and Northolt.	D. F. McIntyre (chmn.), W/C. J. Dobson (gen. mgr.).	Scheduled pass. charter and contract pass. and freight, trooping.	3 Yorks, 3 Dakotas, 1 Consul, 1 Rapide.	—
Silver City Airways, Ltd.**	1, Great Cumberland Place, London, W.1. (Pad. 7040.)	Lympne, Eastleigh and Blackbushe.	Eoin C. Mekie (chmn.), A. Cdr. G. J. Powell (man. dir.), L. R. Pavey (traff. mgr.).	Scheduled and charter vehicle ferry, pass., freight and livestock services.	6 Bristol 170 Mk. 32, 8 Bristol 170 Mk. 21, 1 Consul, 1 Dragonfly. On order: 3 Universal Freighters.	10,910 vehic., 27,270 pass., 1,240 tons freight (sched.); 31 veh.,1,566 pass. 8,429 tons freight (charter).
Skyways, Ltd., and Lancashire Aircraft Corporation,Ltd.**	7, Berkeley Street, London, W.1. (Gro. 7721.)	Stansted.	D. Brown (chmn.), Eric Rylands (man. dir.), J. Clarke (traff. mgr.).	Scheduled, contract and charter (pass. and freight).	28 Yorks, 2 Halifaxes, 3 Dakotas and 47 other types.	55,060 pass.; 737 tons freight; 1,173,430 rev. ton-miles.
Starways, Ltd.	Liverpool Airport, Speke, Liverpool. (Garston 4041.)	Speke.	F. H. Wilson (chmn.).	Scheduled and charter pass. and freight.	Dakotas, Rapides, Ansons.	—
Transair, Ltd.	Croydon Airport, Surrey. (Croydon 7486.)	Croydon.	G. H. Freeman (man. dir.), H. S. Perren (traff. mgr.).	Scheduled and charter pass. and freight.	8 Ansons, 3 Dakotas.	—
Wolverhampton Aviation, Ltd.	Municipal Airport, Wolverhampton.	Wolverhampton.	G/C. C. A. B. Wilcock (chmn.), W. H. Creber (traff. mgr.).	Army co-operation and pleasure flying.	3 Rapides, 2 Geminis, 1 Messenger, 4 Austers.	—
Yellow Air Taxis, Ltd.	Central Chambers, Stratford-on-Avon. (2512).	Elmdon.	H. A. Overington (chmn.), M. L. Champkins (traff. mgr.).	Charter pass., photography.	1 Proctor, 1 Autocrat.	—
Yorkshire Aeroplane Club.	The Airfield, Sherburn-in-Elmet, Yorkshire. (South Milford 378.)	Sherburn-in-Elmet.	R. H. Braime, A. G. Wilson (chmn.), C. Barrett (traff. mgr.).	Charter pass., photography, advertising.	2 Rapides, 2 Proctors, 2 Autocrats.	894 pass.

**Member of British Independent Air Transport Association. *Associate Member of B.I.A.T.A.

CABIN COMFORT

Making the Passenger Feel at Home: a Specialist's Art

The Hermes 4 cabin is an excellent example of avoidance of "tube effect," achieved mainly by using the full fuselage diameter, together with pleasing luggage-rack design and central tubular lighting.

WHAT, for want of a better term, may be described as "passenger psychology" is kept constantly in mind by any airline operator who wants to make his business pay. For each hardened air traveller—the type of businessman who crosses the Atlantic several times a year, or flies between Europe's capitals several times a week—there are probably three or four tourists either making their very first air journey or who fly, perhaps, once a year. The wise operator studies the demands of both classes of traveller (demands, incidentally, that are seldom directly voiced—hence the need for an understanding of psychology) and endeavours to meet them from the moment he gives his specification to the aircraft constructor.

With the introduction, in comparatively recent years, of pressurized interiors, certain aspects of comfort have called for something far more elaborate than mere detail fittings in the cabin itself: thus air-conditioning equipment is now comparable with (but of even higher performance than) the heating and ventilation system of an ultra-modern building, where elaborate machinery is hidden away in the structure and fresh, warmed air of the correct humidity is fed subtly into the living quarters. We see this parallel in, for example, the Bristol Britannia, which has two completely independent systems, one in each wing. Each outer engine nacelle contains a silenced, after-cooled engine-driven blower, and each inner nacelle a refrigerator and ground-running fan. The refrigerators, together with water separators, keep down relative humidity in the cabin when outside conditions are oppressive; or, when moisture is required, the humidity can be raised by injecting steam from an electric boiler into the ventilating air. The main conditioned-air supply is fed into the cabin through upper-wall ducts at the rate of some 25 lb/min, while another 7 lb/min is fed to individual louvres by each seat. Extraction of "used" air, in conformity with modern ventilation practice, takes place near the floor. Any required cabin temperature between 63 and 75 deg F can be automatically maintained.

Here a word may be said on another important psychological point, that of making the passenger feel he is travelling in an essentially safe, solid vehicle and not merely being wafted through thin air in a fragile shell. "Solidity" could very easily be achieved by the use of heavy colours, but in the usual type of modern fuselage such a scheme would at once produce an oppressive, tunnel-like effect. In reaching a happy medium, operators and constructors have displayed the greatest ingenuity, and in some cases the services of prominent industrial designers have been invoked with happy results. Generally speaking, the tendency is towards dark (often blue or blue-grey) carpeting and seating, with walls and ceilings in much lighter shades of the same colour. Curtaining is often in a gay, contrasting colour, and decorative panelling in veneers or plastics is introduced at appropriate points.

The windows fitted in modern British airliners are almost always of double Perspex, the two sheets forming a "dry-air sandwich" with the aid of a dessicant in the space between them. A number of windows—about one for every six passengers—are arranged as pull-out (or, more accurately, pull-in) emergency exits.

Artificial lighting, as in any branch of interior decoration, is closely bound up with artistic effect. In British airliner interiors filament-lighting is generally favoured, though "warmed daylight" fluorescent tubes can give a very pleasing effect if provided with "egg-box" or other types of anti-glare shades. In addition, individual lighting installed flush in the cabin walls alongside each seat is usually provided.

Nowadays soundproofing is bound up with structural design rather than with cabin furnishing, and it may be said to begin with engine installation. The coming of the gas turbine has, in many ways, simplified the problem; a considerable volume of sound arises from sympathetic vibration, so the smooth-running turbojet and turboprop obviate much trouble from the outset. A clean fuselage exterior is also essential, to eliminate wind-whistle, and the silencing of pressurization blowers has also had to receive considerable attention. Soundproofing of the cabin walls is usually achieved by the use of glass-fibre blankets between the fuselage skin and the trim, a greater thickness being employed at crucial points such as those in the region of the airscrews.

It is in seating, perhaps, that the greatest design-ingenuity has been shown. As in the case of air-conditioning, this branch of work is in the hands of a very few specialist firms. In very many cases, seats are individually designed to operators' requirements; the catalogue of an old-established firm illustrates some 60 different types of single, double and triple seat produced within the past few years, apart from crew-seats and other special items.

With the coming of "tourist" services there has been a big demand for the "high-density" type of chair, usually installed in pairs and threes. Even so, the general appearance, upholstery and comfort differ little from that of standard seats; dimensionally they are usually a little less generous, width being saved in the arm-rests, but they retain such refinements as reclining backs (sometimes the movement is limited), detachable or folding tables and non-fume ashtrays. In almost every case that *sine qua non* of comfort in the air, the padded head-rest, is retained.

Lightness combined with strength—the A.R.B. now requires seats to be stressed for loads of 9 g—is the keynote of seat-frame construction, so light-alloy tubing (often magnesium) is almost always employed. Rubberized hair and/or foamed rubber are the usual filling media.

Quick conversion of aircraft interiors from tourist to luxury, or *vice versa*, demands adaptability of seat-placing, so aircraft designers are now providing floor securing-points giving an almost infinite variety of pitch, and the seat manufacturers have evolved some ingenious fittings which, while still meeting the load requirements, permit quick and easy attachment and detachment.

". . . the tendency is towards dark . . .carpeting and seating, with walls and ceilings in much lighter shades of the same colour. Curtaining is often in a gay, contrasting colour." Here is a corner of the Comet.

No austerity: Two excellent approaches to the "high-density" seating problem, by Rumbold, for B.E.A. Discovery-class Viscounts (left) and Vickers-Armstrongs (above). Both are adjustable.

The modern airliner pantry exemplifies functional design at its best; space, weight, time and work are all saved.

Turning now to what house-agents customarily term the "usual offices," it is here that some of the greatest advances in airliner interior design have taken place. In pre-war and immediate post-war days aerial toilet accommodation usually gave a depressing effect of having been installed, as it were, grudgingly; the unfortunate passenger, on his visit aft, was confronted with a dark, draughty, vibrating cell. Today, by contrast, we find in the Comet (for example) a "men's dressing room" and "ladies' powder room," with colour schemes and fittings rivalling those of a luxury hotel in utility and taste; engineers and chemists have co-operated, with startling success, in solving the problems of efficient aerial sanitation, once thought insuperable. The passenger in any aircraft larger than a feederliner now expects to find both cold and hot water laid on (the latter is usually from a storage tank equipped with an immersion heater permitting, perhaps, half a gallon of hot water to be drawn at a time, so conserving the main supply); and men's rooms are equipped with electric-razor power points.

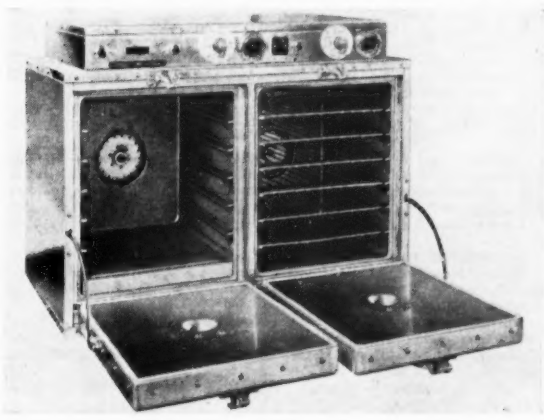
Improvement in galley equipment, though necessarily less spectacular, has been just as marked, one electrical firm in particular having made a close study of aviation requirements, which—all questions of space apart—differ vastly from those in ships or trains. Although the tendency on tourist services is towards "simple" fare, there are still—and always will be—many routes on which full hot meals are served; and when the route is a short one the galley must be faultless in operation and layout (however efficient the stewards) if a major meal is to be served and cleared between take-off and touchdown.

In airline use, actually, the word "pantry" is now tending to replace "galley," and the change is appropriate, for there is nothing suggestive of greasy nautical proceedings. It is not the practice to cook on board; most British operators who serve meals take advantage of the wide range of frosted foods made available by a well-known catering firm. These comestibles are then either de-frosted, or de-frosted and warmed, as the case may be, in electric ovens and served on plastic trays with fitted plates, containers and cups. Here, again, one firm in particular has made a close study of airline requirements, evolving a tray-set which (unlike some plastic crockery) does not impair either the appearance or flavour of the food.

The electric air-circulation ovens installed in B.O.A.C. aircraft can heat 12 frozen meals in 12 minutes, or 36 in 50 minutes, allowing for 14 minutes' warming-up. Food that is to be served cold is kept in a lightweight refrigerator. Additional pantry equipment includes electrically heated food storage containers of various sizes.

Hot water for coffee-making and other purposes is usually supplied by an electric urn (which may also have an egg-boiling container), or hot drinks in smaller quantities can be kept in electrically heated "hot-cups" holding about a quart. A stainless-steel sink and a waste-bin of generous size complete the main pantry equipment. There is also a steward call-system, with push-buttons by each seat and a call-board at the steward's or hostess's station.

Air-circulation oven (the circulating-fans can be seen) supplied by G.E.C. to K.L.M. for their Super Constellations. In stainless steel and light alloy, it weighs 88lb and can heat 60 frosted meals in 25 minutes.



SOME MANUFACTURERS OF CABIN EQUIPMENT

General Furnishing (Upholstery materials, cushioning, panelling, sound-insulating materials, etc.).—Airscrew Co. and Jicwood, Ltd.; Ashdowns, Ltd.; Bakelite, Ltd.; Bell's Asbestos and Engineering, Ltd.; Burgess Products Co., Ltd.; Bury Felt Mfg. Co., Ltd.; Connolly Bros. (Curriers), Ltd.; Thomas de la Rue and Co., Ltd.; Fibreglass, Ltd.; T. F. Firth and Sons, Ltd.; Fothergill and Harvey, Ltd.; Thomas French and Sons, Ltd.; Greenwich Leathercloth Co., Ltd.; Hall and Hall, Ltd.; Hairlok Co., Ltd.; John Holdsworth and Co., Ltd.; Imperial Chemical Co., Ltd. (Leathercloth Division); George O. James, Ltd.; Kapok, Ltd.; Latex Upholstery, Ltd.; Neil Morris, Ltd.; Old Bleach Linen Co., Ltd.; John Peel and Son, Ltd.; R.F.D. Co., Ltd.; L. A. Rumbold and Co., Ltd.; Scottish Aviation, Ltd.; Tenaplas (Sales), Ltd.; Tinkertex, Ltd.; Ernest Turner (London), Ltd.; Wilkinsons (Bradford), Ltd.; Jas. Williamson and Sons, Ltd.; A. H. Vane and Co.; John Wright and Sons (Veneers), Ltd.

Fenestration.—Imperial Chemical Industries, Ltd. (Plastics Division); Triplex Safety Glass Co., Ltd.

Seating.—Christie-Tyler, Ltd.; Lancefield Coachworks, Ltd.; L. A Rumbold and Co., Ltd.; Scottish Aviation, Ltd.; Vickers-Armstrongs, Ltd.; Willowbrook, Ltd.; Wingham Bennett and Co., Ltd.

Air Conditioning, Pressurization, Heating and Cooling.—Artif-Ice Products, Ltd.; Christie-Tyler, Ltd.; D. A. Daniel and Co., Ltd.; Delaney Gallay, Ltd.; General Electric Co., Ltd.; Sir George Godfrey and Partners, Ltd.; M. L. Aviation Co., Ltd.; Marston Excelsior, Ltd.; Normalair, Ltd.; Power Flexible Tubing Co., Ltd.; Siebe, Gorman and Co., Ltd.; Teddington Controls, Ltd.; Thermotank, Ltd.; Vokes, Ltd.

Lighting Installations.—British Thomson-Houston Co., Ltd. (Mazda lamps); General Electric Co., Ltd; Rotax, Ltd.

Intercommunication Equipment.—Ardente Acoustic Laboratories, Ltd.; Easco Electrical, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Standard Telephones and Cables, Ltd.

Galley Equipment.—General Electric Co., Ltd.; J. Lyons and Co., Ltd. (catering with frosted foodstuffs); Vickers-Armstrongs, Ltd.

Tableware.—B. Attewell and Sons, Ltd.; Bakelite, Ltd.

Toilet and Water-supply Equipment.—Elsan Manufacturing Co.; Permutit Co., Ltd.; Teddington Controls, Ltd.; Vickers-Armstrongs, Ltd.; Chas. Winn and Co., Ltd.

Lashing Equipment.—Aerolex, Ltd.; Rollason Aerocessories, Ltd.

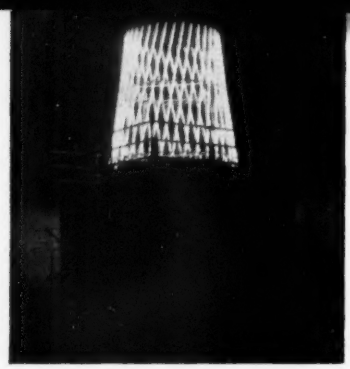
Detail Fittings.—Midland Aeroquipment, Ltd.

Emergency Equipment (life-jackets, etc.)—Elliott Equipment, Ltd.; Frankenstein and Sons (Manchester), Ltd.; D. Lewis, Ltd.; R.F.D. Co., Ltd.; Siebe, Gorman and Co., Ltd.

Interior-decoration Finishes.—Lewis Berger, Ltd.; Cellon, Ltd.; Docker Brothers; John Hall and Sons, Ltd.; Imperial Chemical Industries, Ltd. (Paints Division); Jenson and Nicholson, Ltd.; Llewellyn Ryland, Ltd.; Titanine, Ltd.

AIRPORT EQUIPMENT

A Summary of the more Important Items and their Uses



London Airport beacon (Osram lighting)

MUCH is heard in these progressive days of faster and safer aircraft which are claimed to fly higher and more smoothly with a greater number of passengers than ever before; but it must not be forgotten that an airline is only as good as the ground organization on its routes permits it to be. Basic maintenance arrangements are of paramount importance, and much also depends on the equipment available for quick turn-round of aircraft.

Perhaps the most obvious need is for first-class, risk-free refuelling arrangements. Tanker capacities at the present time vary from 4,000 gallons downwards, and separate tankers must be provided for 100-, 108- and 115-octane petrol and for aviation kerosine—not to mention low-octane fuel for light-aircraft operation. Special under-wing pressure refuelling systems are now coming into use, requiring complementary tanker arrangements, and Comets are already replenished in this way; similar arrangements are incorporated on Viscounts, but at present the slower and more conservative over-wing method is generally employed. This no doubt is because Comet capacity is 7,000 gallons, whereas that of the Viscount is a mere 1,720. Rate of fuel-flow through each hose of a modern tanker may be as high as 200 gall/min, so control arrangements must be both simple and positive. Furthermore, earthing precautions for aircraft and supply vehicle must always be taken before any transfer of fuel is attempted, otherwise there is a serious risk of fire.

Small tankers are used for replenishing oil levels. Turbine power units require special lubricants, a fact which will become of increasing importance as power outputs rise.

A third type of tanker is also employed, carrying relatively small quantities of several different materials, such as methanol, windscreen and airscrew de-icing liquids, and hydraulic fluids.

From refuelling, a logical step is to fire-fighting technique, and in this category there is a great diversity of equipment available. Modern crash tenders will deliver huge quantities of foam and/or CO_2 in very short periods—figures of 3,500 gallons of foam and 2,400 cu ft of gas within one and a half minutes are quoted for one large unit. Trailers are available for small airfields, and there is a whole variety of hand-held or wall-type appliances for every conceivable occasion. The reagent used for putting out the fire may be CO_2, foam, methyl bromide, carbon tetrachloride or "wet water" (water containing chemicals which increase its penetrating power and fire-fighting effectiveness, and at the same time lower its freezing point so that it remains operative in cold weather).

If there is a serious fire in an aircraft, at least one of the crash-tender crew will require to wear protective clothing. The asbestos suits used enable a man to operate amidst burning petrol for three or four minutes: so far as the material itself is concerned, the time could be longer, but human lungs cannot stand the hot air that gathers inside the suit for any greater period. Other asbestos equipment in use includes concertina hose—for connecting air-conditioning vans to aircraft with minimum loss of heat—and pressure hosing, for enabling mobile compressor sets to be coupled to fuselages for the purpose of ground-testing pressurization systems. Air-conditioning vans have a very useful future ahead of them in tropical or arctic climates.

Many other types of vehicle, beyond those already discussed, are to be found at a modern airport. There must be ground-starter units capable of ministering to a wide range of aircraft. Battery-trollies are still in wide use at small fields, but the modern tendency, where large aircraft are catered for, is to replace these with petrol or diesel units that more readily supply the considerable current required: steady outputs of 600 or so amp, with peak loads rising to 1,000-1,500, may be demanded by a powerful aircraft. Cleaning devices of various kinds are required. Amongst these we can include specially designed aircraft vacuum-cleaners that will pick up pieces of metal as well as dust and dirt without damage to themselves—and possibly magnetic sweepers, such as that described in *Flight* last week.

Again, there must be tractors of all sizes. These may be powered by petrol or diesel engines: they normally have pneumatic tyres, and between them must be capable of economically pulling anything from the lightest baggage truck to the heaviest aircraft. Drawbar-height is often variable, and full lighting is provided. Another increasingly useful vehicle is the fork-lift truck. Being equipped with an elevating mast and forks at the front, this type of equipment can pick up all manner of loads and either stack them on top of each other or load them into aircraft. Weights of up to 20,000 lb can be lifted by the largest trucks of this type. Finally, in the transport line, there are the specially-designed airport coaches, usually built to operators' specifications.

We have now examined the main run of mobile equipment likely to be encountered; let us finish by focusing attention on the important static equipment. The centre of this is the control tower, which at a busy airport has three important ground systems to operate—R/T, lighting, and some means of determining the position of aircraft actually on the airfield (navaids in general are discussed on pages 291-292 of this issue). Taking the last first, it is well-known that at the vast airport at Idlewild a ground radar system has been in operation for some time, which has been successful in indicating the positions of aircraft on the ground. This success is doubtless partly due to the equipment itself, and partly to the excellent aerial position high up on the control tower. Experiments have recently been conducted at London Airport with two similar types of equipment.

R/T—now almost invariably V.H.F.—is provided not only for communication with aircraft, but for giving instructions to ground vehicles. These are the crash tenders and other mobile equipment; and aircraft-marshalling staff are often instructed by "walkie-talkie."

Finally, we come to the lighting scheme, which at large airfields is extremely complex. Two systems which have been agreed to by I.C.A.O. are the Calvert and the A.L.P.A.: the former, which has been installed at London Airport for some time past, may briefly be described as follows. Essentially it comprises a long, sloping row of lights situated on the final phase of the approach as a continuation of the centre line of the runway. At right angles across this long line are several bars of lights; there is a threshold bar across the end of the runway; and along both sides of the latter further flush-lights.

In normal visibility, all the approach lighting is red, the landing bar green, and the runway lights white. A high-intensity low-visibility system is, however, provided on the same stands, the difference being that the approach bars are then normally yellow sodium lamps, and the long centre-line white. Taxi-ways have latterly been marked by two rows of blue lights, but a single set of bluish-green ones down the centre is a new recommendation. The whole system is controlled from the tower with the aid of a form of illuminated diagram—a plan of the field which may be up to 300 sq ft or more in area. A flashing identification beacon, and red obstruction lights, complete the picture.

SOME SUPPLIERS OF GROUND EQUIPMENT

Air Conditioning, De-Frosting, etc., Vehicles and Servicing Equipment.—Bryans Aeroquipment, Ltd., Sir George Godfrey and Partners, Ltd., M. L. Aviation Co., Ltd., Rollason Aerocessories, Ltd.

Aircraft Weighing Equipment.—Kenton Equipment, Ltd.

Airfield Equipment (General).—R. K. Dundas, Ltd., Essex Aero, Ltd., S. Grahame Ross, Ltd., the Pyrene Co., Ltd.

Control-tower Equipment.—International Aeradio, Ltd., Short and Mason, Ltd., Thermionic Products, Ltd.

Fire-Fighting Equipment.—Airfoam Fire Protection, Ltd., George Angus and Co., Ltd., Bell's Asbestos and Engineering, Ltd., Coventry Climax Engines, Ltd., General Fire Appliance Co., the Walter Kidde Co., Ltd., Merryweather and Sons, Ltd., the Pyrene Co., Ltd.

Fork-Lift Trucks.—Conveyancer Fork Truck Co., Coventry Climax Engines, Ltd., I.T.D., Ltd., Mathew Bros., Power Jacks, Ltd.

Ground Starter Equipment.—Lincoln Electric Co., Ltd., M.T.E. Control Gear, Ltd., Murex Welding Processes, Ltd., Petbow, Ltd., Peto and Radford, Westinghouse Brake and Signal Co., Ltd.

Hangars, Airfield Buildings, and Associated Equipment.—Bellman Hangars, Ltd., Boulton and Paul, Ltd., Chamberlain Industries, Ltd., Essavian, Ltd., Structural and Mechanical Development Engineers, Ltd., Surrey Concrete, Ltd.

High-Pressure Hosing.—Bell's Asbestos and Engineering, Ltd., Skyhi, Ltd.

Maintenance Rostra, Passenger Steps, etc.—Aero Controls, Ltd., Barnards, Ltd., Merryweather and Sons, Ltd., Moss and Sons, Ltd., Reynolds Tube Co., Ltd.

Marine-base Equipment.—S. Grahame Ross, Ltd., Vosper, Ltd.

Mobile Cranes, Jacks, Lifting Equipment, etc.—Brown Bros. (Aircraft) Ltd., Chamberlain Industries, Ltd., Coles, Ltd., Skyhi, Ltd., Taylor and Sons (Manchester) Ltd.

Pyrotechnics.—Schermuly Pistol Rocket Apparatus, Ltd., The Y.S.C., Ltd.

Radar for Location of Aircraft on Ground.—Cossor Radar, Ltd., Decca Radar, Ltd.

Refuelling and Lubricating Equipment.—Flight Refuelling, Ltd., Steel Barrel Co., Tecalemit, Ltd., Thompson Bros. (Bilston) Ltd., C. C. Wakefield and Co., Ltd., Wayne Tank and Pump Co., Ltd., Zwicky, Ltd.

Refuelling Service.—Esso Petroleum Co., Ltd., Ragosine Oil Co. Ltd., Shell-Mex and B.P., Ltd., Vacuum Oil Co., Ltd.

Remote Control and Telecommunication Equipment.—Automatic Telephone and Electric Co., Standard Telephones and Cables, Ltd.

Runway and General Lighting Equipment.—British Insulated Callender's Cables, Ltd., British Thomson-Houston Co., Ltd., Butlers, Ltd., Chance Bros., Ltd., General Electric Co., Ltd., Harley Aircraft Landing Lamps, Londex, Ltd., St. Helens Cable and Rubber Co., Ltd.

Short-Range Radiocommunication.—Marconi, Ltd., Pye, Ltd., Redifon, Ltd.

Snowploughs.—J. J. Johnston and Co., Ltd.

Sound Equipment.—Ardente Acoustic Laboratories, Ltd., Central Rediffusion Services, Ltd., Communication Systems, Ltd., Redifon, Ltd., Tannoy Products, Ltd.

Toilet-servicing Equipment.—Air Service Training, Ltd.

Tractors, Baggage-Trollies, etc.—Barnards, Ltd., David Brown Tractors, Ltd., P. C. and C. K. Chase, Ltd., Lansing Bagnall, Ltd., Mercury Truck and Tractor Co.

Vacuum Cleaners.—British Vacuum Cleaner and Engineering Co., Ltd., New Welbeck, Ltd.

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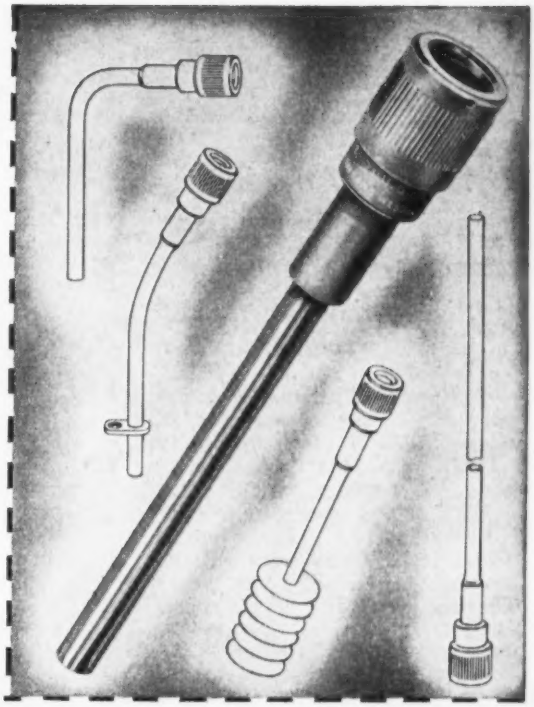

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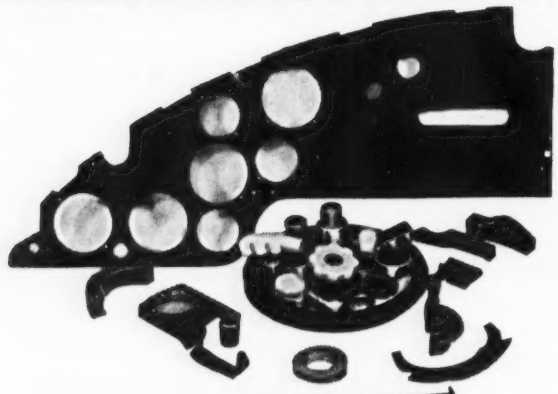

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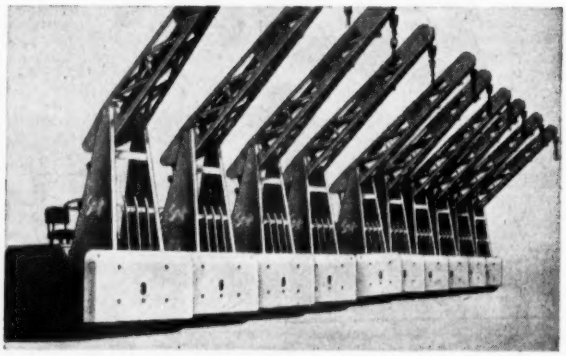

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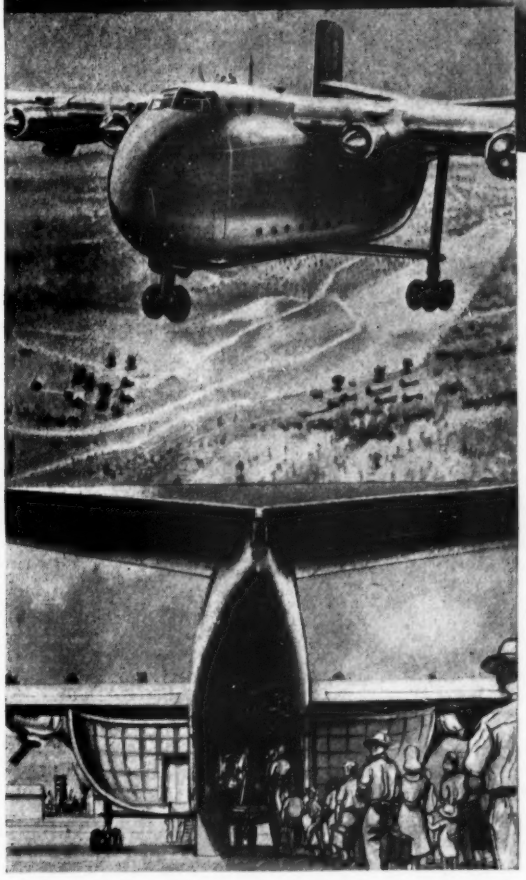

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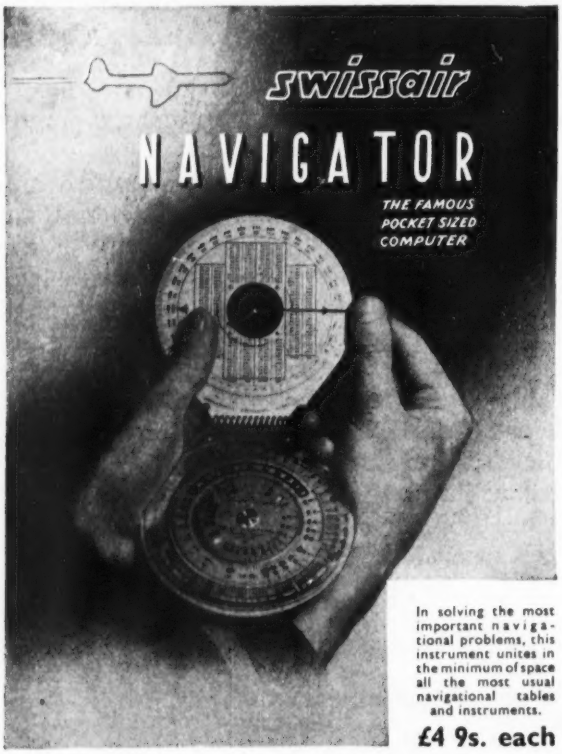

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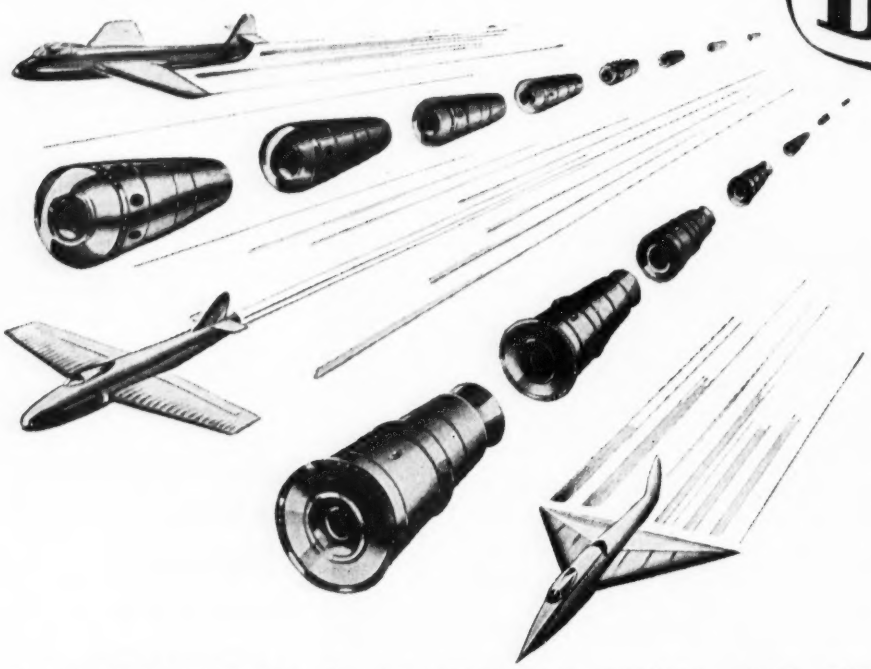

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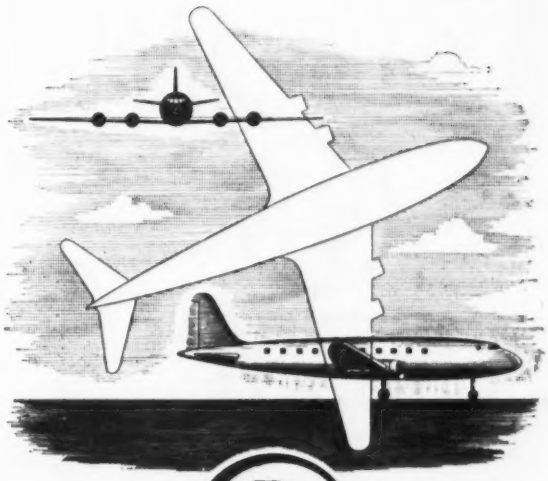

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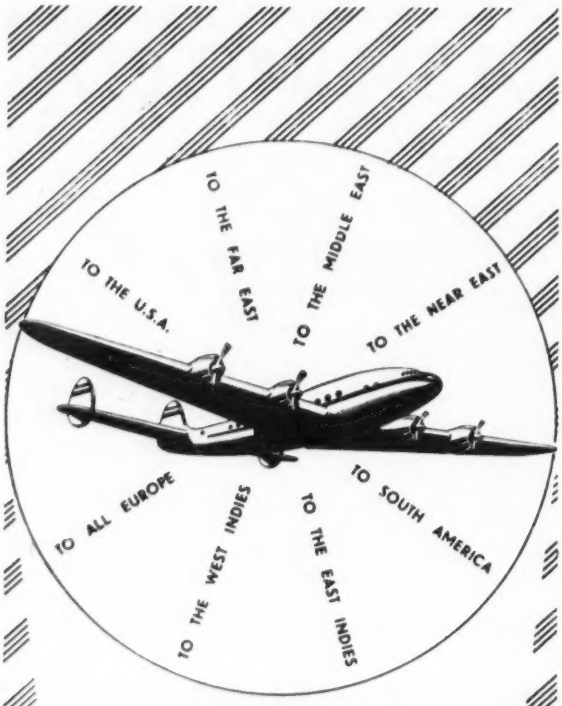

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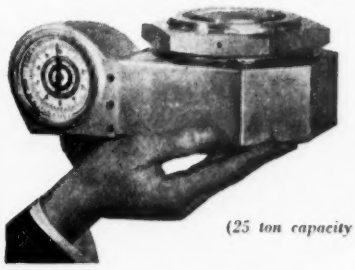

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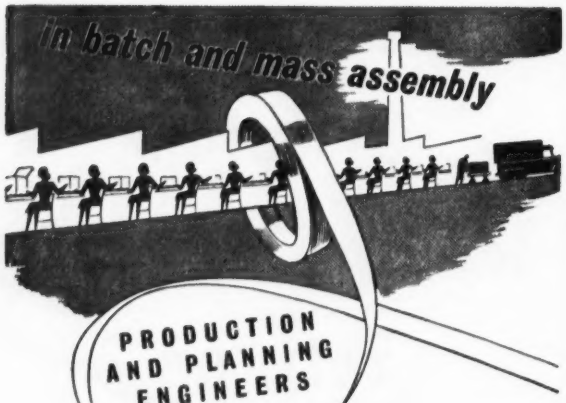

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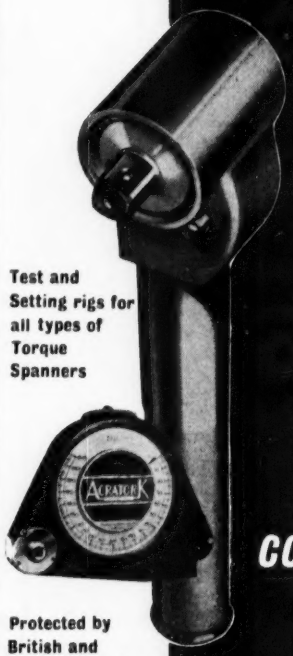

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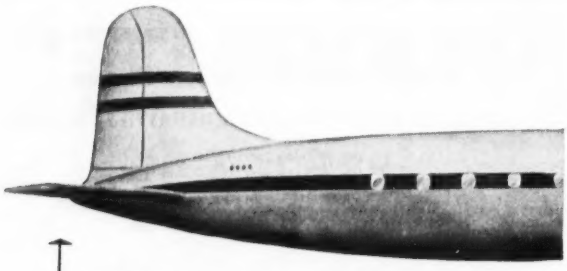

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate sheduled air services:—

APPLICATION No. 168. From Patrick Aviation, Ltd., of 479, Bristol Road, Birmingham, 29, for a U.K. Internal Service with D.H.89 and Dakota aircraft for the carriage of passengers and supplementray freight between Birmingham (Elmdon) and Jersey (C.I.), at a frequency of one service daily May to September inclusive, October to April one service each Saturday with duplicates as desired during the period from March 28th, 1953 to March 27th, 1960.

APPLICATION No. 169. From Transair, Ltd., of Croydon Airport, Surrey, for a Seasonal Inclusive Tour Service with Dakota aircraft for the carriage of passengers and supplementary freight between London (Gatwick) and Graz (Austria) at a frequency of from one service fortnightly to one service weekly, during the period from May 1953 to September 1953.

APPLICATION No. 170. From Airwork, Ltd., of 15, Chesterfield Street, London, W.1, for traffic stops at Prestwick and Keflavik on their "All-Freight" Services between London Airport-Montreal (Dorval) and London Airport-New York (Idlewild) (Applications Nos. 31 and 32), of which approval was announced by the Minister of Civil Aviation on February 13th, 1953.

APPLICATION No. 171. From British European Airways of Keyline House, Ruislip, Middlesex, for a traffic stop at Birmingham on one of the existing International services each week-day between London and Edinburgh and/or Glasgow, from April 19th, 1953 for a period of seven years.

APPLICATION No. 172. From Skyways, Ltd., of 7, Berkeley Street, London, W.1, for a Coach Class Service initially with York aircraft for the carriage of passengers, supplementary freight and mail between London (Stansted) and Kuwait, with an intermediate traffic stop at Cyprus (Nicosia) at a frequency of from one service fortnightly to one service weekly, during the period from July 1st, 1953 to June 30th, 1963.

APPLICATION No. 173. From Lancashire Aircraft Corporation, Ltd., of 7, Berkeley Street, London, W.1, for a Seasonal Inclusive Tour Service with Dakota aircraft for the carriage of passengers between Manchester (Ringway) and Tarbes (Lourdes) at a frequency of one service weekly during the period from May 1953 to September 1953 inclusive.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons and must reach the undersigned within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9, Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections. [9343

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	Commence	*Examination*
Commercial and Instrument Rating	March 10th	April
	April 7th	May
Senior Commercial and A.L.T.P.	Feb. 23rd	June
	April 13th	August
Conversion to A.L.T.P.	March 9th	April
	April 13th	May
Flight Navigator	March 9th	September

THE above courses are offered at the direct tuition rates of 5 gns. per week and include fully illustrated lecture notes. Special terms of 3 gns. per week for those who have completed full courses and require study for specific subjects under supervision.

OBTAIN free details and prospectus from:—

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30, CENTRAL CHAMBERS,
EALING, W.5.
(Opposite Ealing Broadway Underground Station)
Tel.: EALING 6949. [0248

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Complete training facilities to M.C.A. application of I.C.A.O. standards, for all professional pilot/navigator qualifications on the FULL-TIME (personal coaching basis) or "STUDY-AS-YOU-WORK" (lessons, questions, model answers) method. Ideal those in Services or seeking higher licences.

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WRITE FOR ADVICE WITHOUT OBLIGATION. AT THE RECENT A.L.T.P. EXAMINATIONS THERE WERE EIGHT SUCCESSES, ALL STUDENTS OF THIS SCHOOL. COURSES BEGIN EARLY FEBRUARY, THEN ALTERNATING MONTHS.

LONDON SCHOOL OF AIR NAVIGATIONS (1949) Ltd., 33, Ovington Square, Knightsbridge, London, S.W.3. Tel.: KENsington 8221. [0277

TUITION

TWIN CONVERSIONS

GEMINI aircraft, fitted radio. £6 per hour, dual or solo. Southend Flying School, Essex. Rochford 56204. [0333

THE COLLEGE OF AERONAUTICS.

THE Board of Entry of the College invites applications from suitable candidates for the two-year course which begins in October, 1953 and ends in June, 1955. Candidates should be of graduate standard, although the possession of a degree is not essential; a good Higher National Certificate is an acceptable standard. The College, a post-graduate institution, is devoted to the study of aeronautical science and engineering. The curriculum covers the five main subjects of aerodynamics, aircraft design, aircraft electrical engineering, aircraft propulsion and aircraft economics and production. Instruction in the first year is designed to provide students with a broad background of knowledge in all these subjects, with opportunity for limited specialization in two or three of them. In the second year students specialize more particularly, usually in one subject. Experiments in the air are an important part of the work, both in the first year when all students take part in them and in the second year when they are linked to the specialist work of the departments. Students who satisfactorily complete the course will receive the Diploma of the College.—Further particulars and details of the procedure for enrolment may be obtained on application to: The Warden, The College of Aeronautics, Cranfield, Bletchley, Bucks. [9229

AIR SERVICE TRAINING OF HAMBLE provides training in all branches of aviation in their flying, navigation, radio and engineering schools.

DETAILS of the numerous *ab initio* and conversion courses available will be forwarded on application to the Commandant, Air Service Training, Ltd., Hamble, Southampton. [0070

LEARN to fly for £24: instructors' licences and instrument flying for £3 an hour; night flying £3/10/- an hour; residence 5 gns. weekly. Approved M.C.A. private pilot's licence course.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [0253

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., or "no pass no fee" terms; over 95% successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., write for 144-page handbook free.—B.I.E.T. (Dept. 702), 17, Stratford Place London, W.1. [0707

AERONAUTICAL, automobile or agricultural engineering. Practical full-day workshop training with graded technical courses for students with or without G.C.E. Short pre-call up or refresher courses. Syllabus from Engineer-in-Charge, College of Aeronautical Engineering, Sydney Street, Chelsea, Flaxman 0021. [0019

COMMERCIAL pilot's licence, technical "General" and type-rating, conversions, personal instruction. Five-day full-time course for specific type. Special arrangements for urgent requirements. Syllabus from Pilot, College of Aeronautical Engineering, Sydney Street, Chelsea. Flaxman 0021. [0020

FREE! Brochure giving details of courses in all branches of aero eng., covering A.F.R.Ae.S., A.R.B.Certs., M.C.A. exams, etc. We are the only postal training college operated by an industrial organization. Write to E.M.I. Institutes, Postal Division, Dept. F26, 43, Grove Park Road, London, W.4. (Associated with H.M.V.) [0926

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, Essex. Tel.: Rochford 56204. Comprehensive training for private, commercial licences and instructors' endorsements. M.C.A. approved for 30-hour course. Tiger Moth and Auster aircraft fitted with radio. Special facilities for training in instrument ratings. Hourly rates: solo, day £3; night £4. Dual 5/- extra. Contract rate £2/10/-. Link trainer 10/-. No fees or subscriptions. Trial lesson, 30/-. [0332

AIR SERVICE TRAINING offer pre-licence course commencing April 4th, ending June 29th, on the Dakota airframe and/or Pratt and Whitney engines. Each course provides practical experience on the airframe or engine type in addition to instruction on all subjects required for obtaining the licence. Residential facilities available.—Inquiries to The Commandant, Air Service Training, Ltd., Hamble, Southampton. [9338

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

SHORT SERVICE COMMISSIONS IN THE INSTRUCTOR BRANCH OF THE ROYAL NAVY

APPLICATIONS are invited from University Graduates and qualified teachers under 36 years of age for SHORT-SERVICE COMMISSIONS of three, four, or five years in the Instructor Branch, Royal Navy. Requirements are mainly for officers with qualifications in mathematics, science (physics, chemistry, metallurgy), or engineering, but a few vacancies exist for officers with qualifications in history or English with a sound mathematics or science background. After two years' service, officers will be eligible for selection for permanent commissions. A short-service engagement in the instructor branch will discharge any candidate's obligation under the National Service Acts.

(2) Entry will be in two grades. Selected candidates with 1st- or 2nd-class Honours degrees receive approximately £410 in their first year's service, £429 in second year, £548 in third and fourth years, £584 in fifth year. Other candidates receive £319 in first year, £392 in second and third years, £429 in fourth and fifth years. Previous officer service will be recognised for adjustment of seniority and rate of pay on entry. Accommodation and rations are provided or allowances in lieu. Married officers if aged 25 or over receive marriage allowance of £338 per annum, if not accommodated in official married quarters, £293 per annum if they are so accommodated. Married officers under the age of 25 receive marriage allowance of £148 per annum, but are not entitled to be accommodated in official married quarters. An initial outfit allowance of £115 is paid, together with a free issue of certain articles of clothing. A reduced allowance is payable to candidates with previous Naval Service as officers. Tax free gratuities of £300, £400 or £500 are payable at the end of three, four or five years, respectively.

(3) Instructor officers serve both ashore and afloat and their duties include both technical instruction and general education. Officers with suitable qualifications may also be trained and appointed for full or part-time meteorological and weather forecasting duties.

(4) Service in the Instructor Branch will, in the case of officers who enter from contributory service under the Teachers' (Superannuation) Acts, be treated as contributory service, contributions being deducted from the above gratuities. Other officers may have their service in the Instructor Branch similarly treated if they so desire.

(5) Fuller details and application forms may be obtained from Director (P), Naval Education Service, Admiralty, London S.W.1. [9330

DOWTY EQUIPMENT LIMITED

require first class sound

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preferably with some experience of design, development and testing of jet engine accessories, particularly flow, acceleration and speed governing controls, burners and pumps. Exceptional prospects of advancement

SENIOR DRAUGHTSMEN

required for development work on fuel systems. Experience on light hydraulic or pneumatic controls acceptable.

SENIOR DRAUGHTSMEN

for hydraulic and undercarriage department also required.

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Important positions with prospects.

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THE AERODROME WOODLEY, READING

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High salaries offered and good opportunities for advancement in an expanding Design Office.

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Write, giving full particulars of experience to the

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SITUATIONS VACANT

IMPERIAL ETHIOPIAN AIR FORCE TRAINING SCHOOL

INSTRUCTOR IN AIRFRAMES, ENGINES AND INSTRUMENTS

AN ASSISTANT TECHNICAL INSTRUCTOR in airframes, engines, and instruments, is required by the Imperial Ethiopian Air Force. The instructor should, preferably, be an ex-R.A.F. instructor in those subjects, and/or be University trained, with good teaching experience. Salary 9,000 Ethiopian dollars per annum, tax-free (Eth. $7—£1). Free furnished living accommodation in modern bungalow for family, with electric light and power and piped water supply, 27 miles from Addis Ababa. Six weeks' annual leave, of which four are cumulative for home leave.

FURTHER information can be obtained by writing to the Educational Adviser, Imperial Ethiopian Embassy, 17, Prince's Gate, London, S.W.7, to whom applications (own form) giving three references and full particulars of teaching experience should be sent not later than March 23rd, 1953, at the above address. [9288

MARSHALLS' FLYING SCHOOL, LTD., AIRPORT WORKS, CAMBRIDGE

require

(1) Senior technical author. Essential qualifications: wide aircraft experience and ability to supervise illustrators.

(2) Intermediate design draughtsman with aircraft training and preferably with experience in the design of experimental modifications and installations.

(3) Junior draughtsman with aircraft experience.

THESE vacancies are in connection with long-term contracts in a progressive aircraft drawing and design office. Apply, giving full details in confidence to: Personnel Manager, Marshalls' Flying School, Ltd., Airport Works, Cambridge. [9334

PERCIVAL AIRCRAFT LIMITED

invite applications for the position of HEAD OF PUBLICATIONS DEPARTMENT

CANDIDATES applying should be fully conversant with M.O.S. and A.R.B. procedure in respect of publications, spares, appendix "A," and should also possess a good working knowledge of printing and typography requirements. Applicants should, preferably, be qualified illustrators. Good welfare facilities, including canteen and staff pension scheme.

APPLICATIONS, in writing, to the PERSONNEL MANAGER, stating age, experience and salary required. [9294

VICKERS-ARMSTRONGS, Ltd. (Aircraft Section) have vacancies at their Hurn branch (nr. Bournemouth, Hants) for the following staff:—

DESIGN DRAUGHTSMEN
(Aircraft experience preferable but not essential)
AIRCRAFT STRESSMEN
SENIOR AND JUNIOR WEIGHTS ENGINEERS
(for aircraft work in design office)

APPLY, in writing, to the Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, Surrey.

APPLICATIONS, with certain exceptions, are subject to the approval of the Ministry of Labour and National Service. [9327

HANDLEY PAGE, Ltd., have vacancies for:—

AERODYNAMICISTS of degree standard or with H.N.C. in aero subjects. Previous experience preferred.

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SENIOR design and intermediate draughtsmen, preferably with aircraft experience, for Cricklewood and Radlett offices. Consideration will be given to applicants with experience in light structural or mechanical engineering. Possession of O.N.C. or H.N.C. (Mech. or Elect.) an advantage.

WEIGHT control engineers with O.N.C. (Mech.) Previous experience preferred.

TECHNICAL assistants of degree or H.N.C. (Elect.) standard for the design and development of aircraft electrical systems. Previous experience preferred.

SENIOR and junior assistants of degree or H.N.C. standard for the Mechanical and Structural Test Dept. at Radlett.

WRITE, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [9291

LICENSED radio engineer and radio mechanics at our base at Stansted Airport, Essex.—Apply by letter or telephone to the Senior Radio Engineer, Aviation Traders Ltd., Southend Airport, Essex. Tel.: Rochford 56491. [0060

GENERAL mess manager required at an R.A.F. station in Northern Ireland. Accommodation available at a nominal charge. Bachelor preferred. Free messing if living in. Salary £500 per annum.—Reply Box 5738. [9347

SENIOR, intermediate and junior draughtsmen urgently required for aircraft work of super priority. Revised A.E.S.D. rates upwards, depending on ability. Aircraft experience desirable, but not essential.

APPLY: Personnel Manager, Helliwells, Ltd., The Airport, Walsall, Staffs. [9328

TECHNICAL illustrator required, aged 23 or over, with considerable practical experience.—Applications in writing to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [0283

URGENTLY required by engineering firm of repute in north-west district, plant and equipment draughtsman, used to general maintenance work, plant layout and services. Must be capable of working on own initiative. —Apply, Box 5199. [9248

WESTLAND AIRCRAFT Ltd., Yeovil, Somerset, require stressmen, junior and intermediate draughtsmen and technical writer.—Applications, stating age, experience and salary required, should be addressed to the Personnel Officer. [9240

ESTIMATOR required with comprehensive experience of sheet-metal production; ratefixing experience an advantage.—Written applications only to the Personnel Officer, The de Havilland Engine Co., Ltd., Leavesden Aerodrome, nr. Watford, Herts. [9297

RATEFIXER planner, essentially machine shop, but with ability to ratefix aircraft sheet-metal details, required for interesting programme of work with good prospects.—Apply by letter only to Field Aircraft Services, Ltd., Nottingham Aerodrome, Tollerton, Notts. [9261

CHIEF inspector required for factory in Surrey. Full knowledge A.I.D. and C.I.A. requirements as related to rubberised textiles and light engineering. Write details age, experience and salary required.—Box 5705. [9044

H. M. HOBSON LTD.

have vacancies in their

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WEIGHTS ENGINEER

to take charge of Weight Control Section

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The work is varied and interesting and embraces Flying Controls, Fuel Metering Systems, Hydraulic and Pneumatic Servo-Mechanisms.

Good salaries and sound prospects offered to the right applicants.

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may have the vacancy in Test Lab., Design, Jig and tool or Stress Office for which

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LUTON AIRPORT • BEDS.

SITUATIONS VACANT

AIRCRAFT INSPECTORS. Skyways, Ltd., require additional experienced engine inspectors and airframe inspectors at Stansted Airport. "A" and/or "C" licence an advantage. Minimum rates: £11/5/6 to £13/10/6.—Write: Personnel Manager, 7 Berkeley Street, W.1. [9321

SENIOR and intermediate design draughtsmen, with good experience of aircraft or flight structural or mechanical engineering, required for aircraft and armament project work.—Apply by letter to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [9260

JIG and tool draughtsmen, fully experienced, required by Percival Aircraft, Ltd., Luton Airport, Beds. Good working conditions and full welfare facilities, including staff pension scheme.—Applications to the Personnel Manager, stating age, experience, salary required. [0600

CHIEF storekeeper required for aerodrome situated in Home Counties. Must be fully conversant with reserve flying school stores procedure and able to take full control of technical, barrack and clothing stores, etc. Single accommodation available. Apply, giving full particulars of experience and salary required.—Box 5670. [9331

PRECISION engineering company, S.W. Greater London has immediate vacancies for skilled craftsmen—instrument makers, detail fitters and turners, for important rearmament contracts. High rates for the right men. Overtime involved. Good conditions, canteen, sports club.—Apply Box 5971. [9332

STRESS and weights engineers with aircraft experience are required by the English Electric Co., Ltd., Aircraft Division, Warton Aerodrome, nr. Blackpool. Salaries commensurate with experience.—Apply, quoting ref. 3145, to Central Personnel Services, English Electric Co., Ltd., 336-7, Strand, London, W.C.2. [9300

WANTED, Draughtsman for aircraft conversion and repair organization. Previous experience in the aircraft industry essential; preference given to applicants with some experience of radio and electrical wiring.—Apply, by letter, to Field Aircraft Services, Ltd., Nottingham Aerodrome, Tollerton, Notts. [9301

SENIOR draughtsmen required for work on gas turbine fuel systems. Experience in light hydraulics an advantage, but not essential. Excellent conditions. Five-day week. Good salary offered. Apply in writing to Personnel Manager, Joseph Lucas (Gas Turbine Equipment), Ltd., Shaftmoor Lane, Hall Green, Birmingham 28. [9324

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [9420

URGENTLY required by engineering firm of repute in north-west district, draughtsman with experience in the design of rigs and testing fixtures as applied to internal combustion engineering. Only those with experience and who can design and work on their own initiative need apply.—Apply, Box 5198. [9247

THE DE HAVILLAND AIRCRAFT Co., Ltd., Airspeed Division, Christchurch, Hants, require a metallurgist. Work embracing control, material testing, kindred developments, applicant with broad experience preferred.—Write stating age, qualifications and salary required, to the Personnel Manager of the above firm. [9272

APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aero-engine design desirable, but not essential. Also checkers. —Please write, stating age, and giving details of previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0930

DEVELOPMENT engineers, designers, draughtsmen and modification draughtsmen, technicians, technical writers, technical illustrators, technical assistants, stressmen, spares compilers and tracers required for aircraft pressurizing, high-altitude breathing, etc.—Fully detailed applications, with salary required to Personnel Officer, Normalair, Ltd., Yeovil, Somerset. [9239

VACANCIES exist for senior, intermediate and junior design draughtsmen for work on new aircraft. Permanent positions for suitable applicants. Facilities for cheap flying with firm's flying club. Assistance given with housing accommodation.—Applications in writing, stating age, experience and salary required, to Chief Designer, Auster Aircraft, Ltd., Rearsby, Leics. [9137

REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds., several draughtsmen with comprehensive experience of engine installations and allied systems. Good welfare facilities, including staff pension scheme.—Applications, in writing, stating age, qualifications, experience and salary required, to the Personnel Manager. [0901

ASSISTANT manager required for general aircraft sales division. The position involves sales office work and some representation in the field. Applicants (age 30 to 35 years) must have suitable qualifications and good aircraft engineering background. Applications in writing in first instance, giving full information and experience, to Palmer Tyre Ltd., General Aircraft Sales, Penfold Street, London N.W.8. [9333

BRITISH EUROPEAN AIRWAYS have vacancies for aircraft inspectors (Grade II) at Renfrew. Applicants must have had at least four years' experience of overhaul and maintenance of engines, airframes or instruments. Possession of the appropriate licence for Dakota or Viking aircraft is desirable. Salary scale £10 10s. 6d. to £12 8s. p.w.—Applications in writing to Base Personnel Officer, British European Airways, Renfrew. [9348

SENIOR production engineer required by large engineering firm in Leicester in connection with the manufacturing problems of industrial gas turbines. A high salary can be offered to a man suitably experienced in production planning in the aircraft gas turbine field. All applications treated in the strictest confidence.—Please write, giving full details, quoting ref. AAJD, to Box 5705. [9342

THE DE HAVILLAND ENGINE Co., Ltd., require a mechanical engineer, preferably with some experience of electronic recording equipment for vibration measurement and analysis on gas turbine and piston engines.—Please write in confidence, stating age and full details of previous experience, to The Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middx. [9345

A. V. ROE and Co., Ltd., require a radio operator for all crew duties on flight test work at Woodford Aerodrome, Cheshire. Applicants must possess a current M.C.A. air operator's licence and should be interested in the installation of various types of radio facilities fitted in the present-day aircraft.—Write, giving full particulars of previous experience, age, etc., to the Labour Manager, A. V. Roe and Co., Ltd., Greengate, Middleton, Manchester. [9275

SAUNDERS - ROE, Ltd., invite applications from draughtsmen, aerodynamicists, and stressmen willing to work on an interesting design programme whilst living in pleasant surroundings on the Isle of Wight. Aircraft experience is desirable but not essential. Housing accommodation is available for selected applicants. Those interested should apply, stating age, experience and salary required, to the Personnel Officer, E. Cowes, Isle of Wight, quoting reference F C.1. [9325

VICKERS-ARMSTRONGS LIMITED

have vacancies in their

GUIDED WEAPONS DEPARTMENT

for the following Staff :—

(1) ELECTRONIC ENGINEERS of degree standard, with at least three years' experience in one of the following: V.H.F. Transmitter and Receiver Design, Pulse Techniques, Aerials, Transformer Design, Servo-Mechanisms and Electro-mechanical Devices.

(2) TECHNICAL ASSISTANTS with H.N.C. or C. & G. standard, for Development Work, Electronics, Servo-mechanisms and Hydraulics.

(3) DRAUGHTSMEN with experience in Electronic, Electrical or Electro-mechanical Design.

(4) JIG AND TOOL DRAUGHTSMEN.

Apply, quoting reference G.W., to :

Employment Manager
VICKERS-ARMSTRONGS LIMITED
Weybridge Works
WEYBRIDGE, SURREY

Applications, with certain exceptions, are subject to the approval of the Ministry of Labour and National Service.

AEROSERVICES (LONDON) LIMITED

have been favoured with instructions by

TRANSAIR LIMITED

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now surplus to their requirements

All aircraft have valid Cs of A. and are in excellent condition.

Dual control is available.

All aircraft have the following radio installation:
MF HF TR.1154/1155
TR.1430 VHF (8 channels)
Radio Range Receiver
Command Beam Approach R.1598/99
Fan Marker Receiver BC.3574

Substantial stocks of engine and airframe spare parts would be included in the sale.

Principals only to :

AEROSERVICES (LONDON) LTD.
46 Hertford Street, Park Lane
LONDON, W.1

Tel.: GROsvenor 8383 Cables: Aeropaul, London

SITUATIONS VACANT

ENGLISH ELECTRIC have vacancies for aircraft draughtsmen at Warton Aerodrome, near Blackpool. Men with good aircraft drawing office experience are invited to apply for these interesting positions which carry good salaries. Write, giving full details, quoting ref. 120S, to Central Personnel Services, The English Electric Co., Ltd., 336-7 Strand, London W.C.2. [9337

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable. Good welfare facilities including staff pension scheme.—Applications, stating qualifications, experience, age and salary required, to Personnel Manager. [0596

VACANCIES exist for senior, intermediate and junior design draughtsmen and for senior stressmen and planners for work on new aircraft. Permanent positions for suitable applicants. Facilities for cheap flying with firm's flying club; assistance given with housing accommodation.—Applications, in writing, stating age, experience and salary required, to Chief Designer, Auster Aircraft, Ltd., Rearsby, Leics. [9259

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero-engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0632

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen and stressmen, for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [0595

THE ENGLISH ELECTRIC Co., Ltd., have vacancies for technical assistants of H.N.C. Standard to take charge of development structural tests as part of a comprehensive programme of testing on guided weapons. Previous experience of structural development or aircraft stressing an advantage. Apply, stating age and experience and quoting ref. 1042D to Central Personnel Services, English Electric Co., Ltd., 336/7 Strand, London, W.C.2. [9323

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THE ENGLISH ELECTRIC Co., Ltd. require the services of a specialist engineer for thermodynamics and gas dynamics for guided weapons propulsion units. Experience in practical design work and theoretical investigations essential. Only graduate engineers or physicists can be considered. Please reply, quoting ref. 1023A, to: Central Personnel Services, English Electric Co. Ltd., 336/7, Strand, London, W.C.2. [9322

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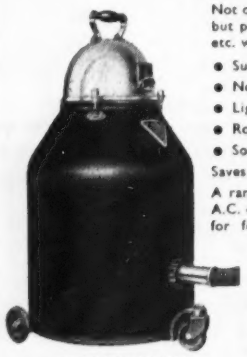

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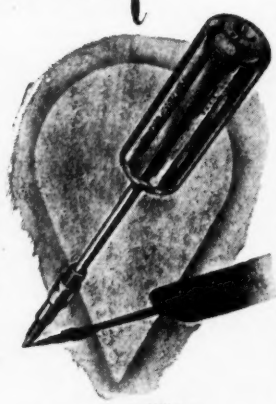

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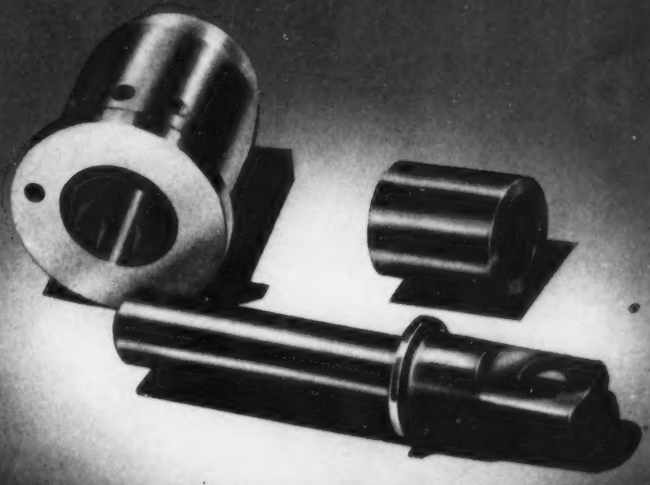

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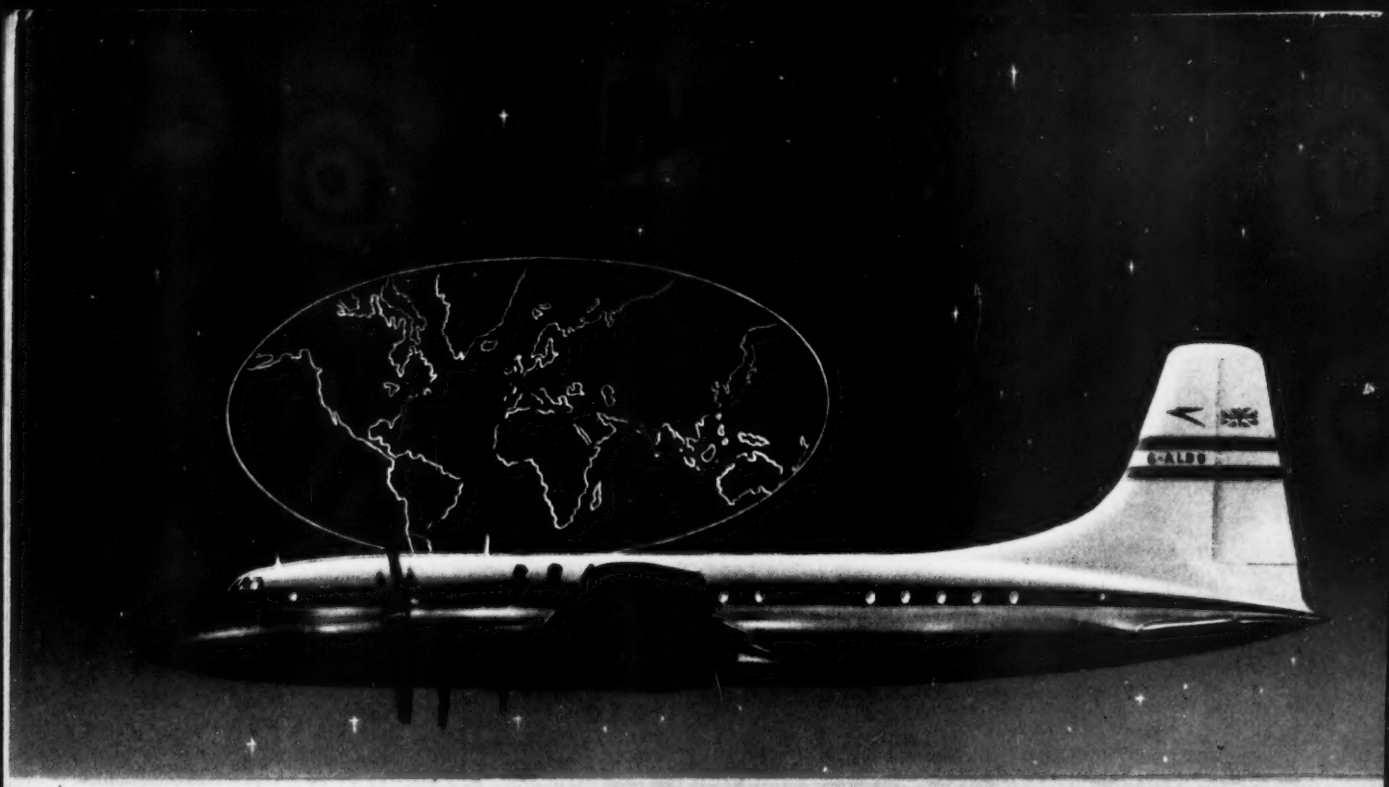

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